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Battelle Technical Review

IN THIS ISSUE:

Reactor Materials Pace Nuclear Progress

VIGNETTE

PHYSICIST

J. Frank Byrne

"We hear constantly about how much we need original research, and without question, the need is great. At the same time, we should not neglect the advances that can come from putting to better use the tremendous backlog of knowledge already available to us." Thus comments J. Frank Byrne, Battelle physicist. He goes on to point out that our existing knowledge is sufficient to solve many of the problems now challenging us. Like the farmer, "we don't farm nearly as well as we know how, now". Frank believes that if we can free ourselves from traditional methods and become more creative in interpreting and using what we have already learned, our technological progress can be greatly speeded.

When he joined Battelle in 1946, Frank undertook studies on the chemical and physical nature of combustion, including the kinetics of the process. Since those early years, he has participated in a widening circle of research particularly into the new method of electrostatic photography, xerography. In this field of electrostatics he has explored processes of charge transfer in voids or small air gaps, the electrification of particles and insulating fluids, and the dynamics of powder clouds. He has investigated the mechanisms of recording materials and techniques for the use of color in the field of the graphic arts. Currently he has major responsibilities in the expansion and development of the xerographic method of reproduction.

He has also been associated with studies of the structure of nonwoven fabrics and of techniques for binding them.

Prior to his association with Battelle, Frank carried on research at General Electric's Pittsfield, Massachusetts plant. During that period he contributed to the development of high-frequency capacitors for power oscillators not using mica which was then in short supply. His formal technical training was gained at Mississippi College, where he received his B.A. degree, and at New York University, where he received his Ph.D. degree, both in physics. He is a member of the American Physical Society and of Sigma Xi.

Along with his wife, Helen, Frank is looking forward to the graduation of their son with a degree in physics. Their daughter is an active junior in high school. Both Helen and Frank have a deep interest in the international student exchange program. In lighter moments they share the enjoyment of folk songs, and Frank pursues his interest in tropical fish.

BATTELLE TECHNICAL REVIEW

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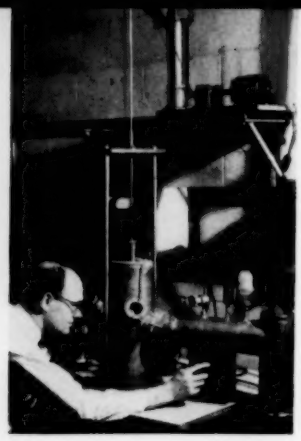


PURIFYING REFRACTORY METALS FOR SPECIAL STUDIES

Only recently have "floating-zone" purification techniques been developed for removing impurities from tungsten, rhenium, and other metals that melt at temperatures even higher than 6000 F. Now scientists have refractory metals available in the purities necessary for research on their true basic properties—mechanical, chemical, electrical and others.

In the equipment shown above, Worth Allred of Battelle's Physical Chemistry Division is observing the purification of a refractory metal for study by Institute technologists. They utilize the high purity specimens for determining various properties of interest in such fields as metallurgy, atomic energy, and solid-state physics.

Heat for melting the metals is supplied by streams of electrons, which boil from the white-hot filament. To protect the easily contaminated metal, melting takes place in a vacuum chamber; and the specimen, supported at each end, is passed through the chamber and the circular filament (top, right) without touching the apparatus.

Impurities are swept along the metal by the moving molten zone. A special device that signals the exact moment when the zone become molten and newly developed controls for regulating the emission of electrons from the cathode have been installed in the equipment to assure a high degree of purity in the metals processed.

A purified rhodium specimen is being examined after processing, in the photo at the lower right.

Reactor Materials Pace Nuclear Progress

by R. F. Dickerson

The development of more efficient nuclear reactors depends largely upon the success of reactor metallurgists in finding better fuel alloys and materials and in designing improved fuel elements. The author reviews the important steps that have made current reactor practice possible, and he discusses the areas of research that are likely to be most fruitful in the future.

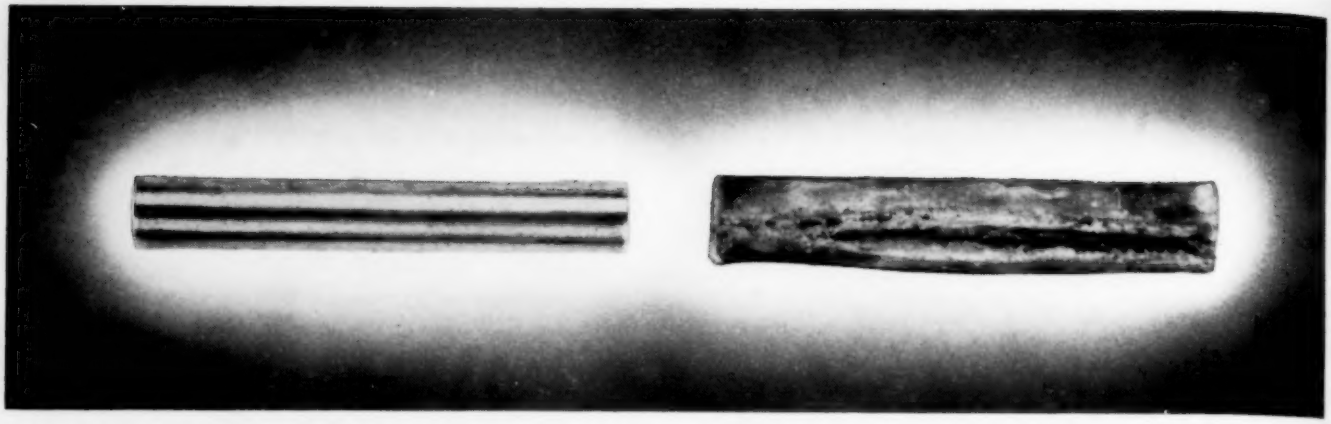
If one considers the scientific progress of the past 20 years, it is easy to conclude that no other period in history is its equal. There is little doubt that the greatest contribution of this fertile period was the successful harnessing of the power of the atom in 1942, in the now-famous Chicago Pile. As is so often the case, this one great advance was the key which opened many doors and thereby affected all scientific disciplines. One of these disciplines was metallurgy. Cyril Stanley Smith states the case well in his foreword to the book *Metallurgy and Fuels* when he says, "Interesting things are always likely to happen when one area of knowledge meets another, and this has been particularly true of the interplay of the extremely old profession of metallurgy with the youngest branch of science, nuclear physics. Metals have always been at the forefront of achievement in art and in engineering, but metallurgists now find themselves associated with those whose thinking is at the very frontier of the nature of matter itself".

As a result of this association, the metallurgist concerned with reactor technology must deal with all the problems confronting materials people in other fields, plus problems that are unique to the field of nuclear energy. The unique problems are the direct result of the new and different environment in which reactor materials must perform their required funcsion. The environment includes continual bombardment by high-energy neutrons and, in the case of nuclear fuels, a buildup of fission-produced metal and gas atoms within the structure. The high-energy or "fast" neutrons move through the materials and disarrange the normal atomic structure, thereby causing changes in properties. In addition to possible fast-neutron damage, the fuel receives the metallic and gaseous fission products into its structure and may suffer severe dimensional changes as a result.

Advances in Materials Technology

The new problems and new solutions resulting from this unique environment have given rise to a specialized group of technical men. These scientists and engineers refer to themselves as "reactor metallurgists" and to their field as the field of reactor materials. During the past 20 years the efforts of these individuals have been responsible for more advance in the technology of rare and reactive metals than had occurred during any period in the history of metallurgy.

It is interesting to note that during the brief history



The problem the reactor metallurgist is trying to forestall is illustrated here. The photo on the left shows a reactor alloy fuel pin (normal size) before irradiation. On the right is the same pin, showing the damage that can be caused by the build-up of fission products after a period of exposure in a reactor.

of atomic energy most new advances in the over-all field were made possible by advances in materials technology. Knowing full well that wihin five years one could have different opinions, some advances in materials are discussed here which have been, in one metallurgist's opinion, vital to nuclear-energy progress.

Uranium

The first really great metallurgical contribution was the preparation of the uranium metal fuel loadings for the first Hanford Production Reactor. When one considers that before 1940 there were probably no more than a few pounds of metallic uranium available in the entire world and that this was of doubtful purity, the magnitude of the accomplishment becomes apparent. An equally imporant accomplishment was the separation of the U-235 atom from normal uranium and the preparation of uranium of various U-235 contents. This, of course, made possible the variety of reactor designs which are now operating or are in various stages of design and construction.

R. F. Dickerson has been associated with reactor metallurgy studies since he joined Battelle in 1948. He has participated in, and is now responsible for directing research on fuel alloy development and melting and casting of reactor materials, metallographic studies of reactor materials, and investigations of radiation damage. Earlier, he was a member of the faculty of Virginia Polytechnic Institute's metallurgy department. The author's studies have provided the basis for more than a dozen previous articles.

Aluminum-Uranium Alloys

Chronologically, the next advance was the development of the aluminum-uranium alloys in which enriched uranium is actually dispersed in an aluminum matrix. These alloys are now standard fuel for swimming pool reactors and low-temperature-water test reactors. The real contribution made by these materials was not the fact that they were a new fuel, but, rather, that a new fuel concept was introduced. In these alloys, the fuel ($UA1_4$) is dispersed as separate particles in an aluminum matrix. As a result of this, the aluminum matrix, which allows neutrons to pass through it with relative ease, can contain any gas which is released by, or local growth which occurs in, the fuel particle. As will become clear in succeeding paragraphs, this dispersed fuel concept was vital to the development of other fuel materials that can be used under much more severe operating conditions.

Along with the introduction of the aluminum-uranium alloy fuels, a technique was developed that made possible the production of flat-plate-type fuel elements bonded on all sides to a protective cladding. This consisted basically of roll cladding a composite assembly of cladding metal and fuel core, and it is known as the "picture-frame technique". All flat-plate fuel elements requiring a metallurgical bond between cladding and core have been produced in this manner since the first loading was made for the MTR in 1952.

Zirconium

In 1948 the thermal-neutron cross section of a metal known as zirconium was redetermined and found to be 0.4° barn instead of 2.5 barns and subsequent research showed that high-quality metal was resistant to serious corrosion by 680 F water. It was also found that corrosion-resistant zirconium-uranium alloys containing uranium in amounts up to 20 per cent could

be prepared. These advances accelerated the Naval Reactor Program and made the early success of pressurized-water reactors possible. The land-based prototype of the submarine reactor was completed in 1953 with unalloyed zirconium as the structural material, but by 1955 when the Nautilus ran her first sea trials zirconium alloys had replaced unalloyed zirconium. Although the development of basic technology for another metal, in this case zirconium, within the short span of six years is in itself an impressive accomplishment, the success of the Nautilus was symbolic of another great advance. An entirely new technology grew, and produced to exacting tolerances, a propulsion power plant from materials that were almost unknown six years before.

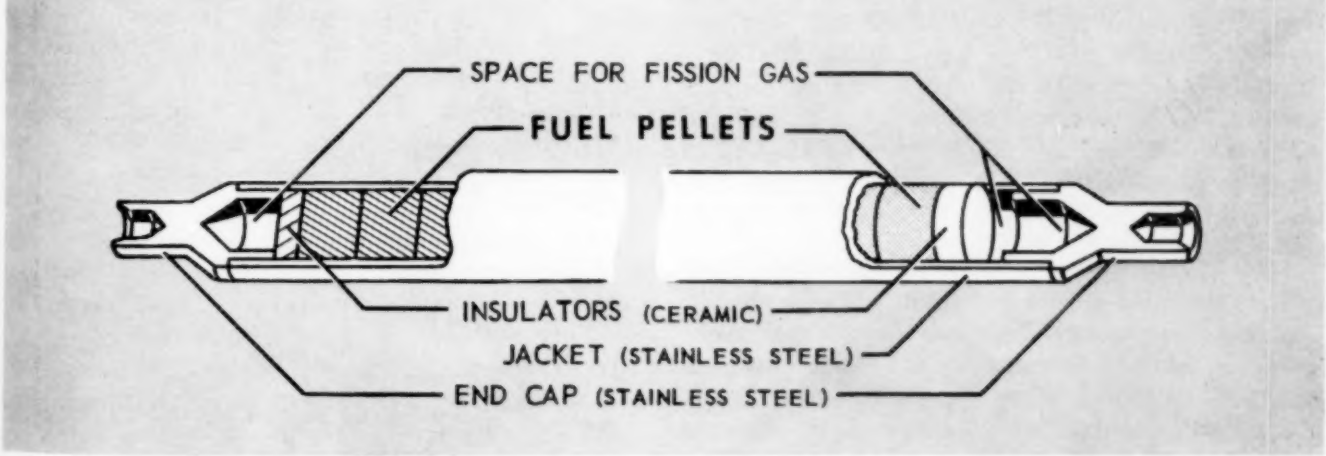
Although the zirconium alloy of low-uranium content used for fuel in the Nautilus has proved itself by actual operation, it is too expensive for a power reactor. The uranium in the fuel is nearly pure U-235 and economic studies indicate without doubt that it is desirable to use as low an enrichment as possible for power reactor fuels. This means that a high uranium density is required. As a result of this need, the so-called gamma-phase uranium alloys were developed. In these materials the isotropic gamma uranium phase is stabilized by the addition of either molybdenum or niobium. However, since only about 10-15 per cent of the alloy addition is used, a high uranium density is achieved so that low enrichments can be utilized. These alloys exhibit a corrosion resistance in hot water (550-680 F) which is several orders of magnitude better than unalloyed uranium and are compatible with other coolant media such as liquid sodium. Because they possess good strength at temperatures up to 1150 F they are able to restrain some irradiation-induced swelling and consequently can withstand burnup of several per cent of the fissionable uranium atoms. The Fermi I Fast Breeder reactor, designed by the Atomic Power Development Associates, will use a uranium-10 w/o molybdenum gamma-phase alloy for its first core loading.

Uranium Oxide

In 1954, research and development was initiated with the objective of constructing a pressurized water power reactor. As a result of this work, the decision was made to use uranium dioxide as a blanket material in a core which contains a small amount of enriched fuel as a "seed" surrounded by a quantity of non-enriched fuel known as the "blanket". This decision was responsible for the introduction of a new fuel material, UO_2, and a different philosophy for handling the gas produced and released as a result of the fission process. The material is a ceramic and as such has a poor thermal conductivity but also has a very high melting point (2760 C). It is compatible with stainless steel, zirconium, and a number of the so-called superalloys and exhibits a corrosion rate in high-temperature water which can be tolerated in most designs. The introduction of UO_2 brought with it a new philosophy for handling fission gas.

Previously, it was believed the fuel should retain the gaseous products of fission. The UO_2 structure has a number of places for the fission products to lodge, thereby reducing the need for the UO_2 body to swell. This is an attractive property for low-temperature operation. Nevertheless, the ceramic nature of the material makes it attractive for high-temperature

*Due to reduction in hafnium content, the cross section has since been established at 0.18 barn.



Cut-away drawing of a typical uranium-dioxide fuel pin. A pin of this type measures ⅜ inch in diameter and six feet in length. As many as 90 such pins may be combined to make a single fuel element. When in use, the pins stand vertically in the reactor core.

applications. The poor thermal conductivity does not allow fission-produced heat to escape easily and consequently fuel temperatures become quite high. The diffusion rate of the released gases increases with temperature and therefore gases diffuse through the porous oxide in the ceramic body. This must be contrasted with the retention of gas by a metal. Current practice makes use of the cladding as a pressure vessel for containment and provides for reservoir space in the fuel-element design to hold the released gas.

In 1957, the first consumer power generated by nuclear energy was produced by the UO_2-fueled Pressurized Water Reactor at Shippingport, Pennsylvania. The impact of UO_2 as a fuel on the reactor field is illustrated by the number of reactors now under construction which will be fueled with this material. These include the Yankee Atomic Power Reactor, the Dresden Station Reactor, the Northern States Power Reactor, and the Nuclear Merchant Ship Reactor.

Although UO_2 in itself has been responsible for a great forward surge toward the goal of economic nuclear power, the fact that its use established the feasibility of ceramic-type fuels may be of far greater importance to the future of nuclear energy. With these materials the increased reactor operating temperatures and fuel burnups, which are essential for economic power, can be achieved.

Uranium Oxide in Stainless Steel

The use of the aluminum-uranium alloys discussed previously was responsible for the development of the dispersion-type fuel element which is now typified by the UO_2-in-stainless-steel concept. This advance in fuel technology has made possible an increase in reactor operating temperatures while at the same time allowing for a compact design. It combines the advantages of UO_2 with the good thermal conductivity and ductility of a metal matrix. The potential for higher temperature operation is provided by the use of matrix material other than stainless steel and dispersed fuels such as UN or UC. Stainless steel-UO_2 dispersion-type elements have given excellent service since 1957 in the pressurized-water-cooled Army Package Power Reactor-1 and should prove satisfactory in compact gas-cooled reactors operating at fuel element surface temperatures in the range of 1500 F.

Other Developments

Since the trend in nuclear reactors will undoubtedly continue to be toward high operating temperatures, advances in high-temperature structural materials must also be considered as important. As a result of this impetus, the last two year have seen surprising advances in the metallurgy of columbium. High-purity columbium is no longer a laboratory oddity; it can now be purchased from a number of suppliers in large poundage lots. Its high-temperature properties have been improved by alloying and its compatibility with various coolant media has been established. In a like vein, iron-chromium-aluminum and other alloys have been developed to the point where temperature limitations have been raised.

In the area of fuel-element fabrication, the last year has seen the development of a technique which will undoubtedly play an important role in the reduction of fuel-element fabrication costs. The method, gas-pressure bonding, will bond entire assemblies of complex shapes, allow brittle materials to be bonded, and will provide close dimensional control. These factors are important when one realizes that a single fuel assembly might consist of 60 to 80 separate parts which must be bonded to each other in some way.

Looking to the Future

In the opinion of the writer the developments discussed in the preceding paragraphs are those which have made the greatest impact on the over-all progress in the field of nuclear energy. If it were necessary to choose only three of these as being the key contributions of the period, they would be as follows: The development of (1) uranium technology, (2) UO_2 fuel, and (3) zirconium technology.

This attempt to evaluate past contributions will be concluded with a consideration of the materials developments which may well be key advances within the next five-year period. Generally the field of ceramic fuels will become increasingly important, but specifically it is believed that uranium monocarbide and fueled graphite will emerge as the greatest fuel developments of the period. The excellent work done by the National Laboratories in plutonium metallurgy will be expanded by industrial participation, and this material will rapidly reach the stage of development needed to establish it as the fuel of the future. Columbium-base uranium alloys will become a standard high-temperature fuel for special applications, and specialized powder coating techniques will allow the full potential of high fuel-loaded dispersions to be achieved. Finally, the effects of irradiation on fuel materials will be understood to the degree that reactor engineers will be able to design reactors so that long fuel life and high fuel burnup can be achieved.

Future progress in the field of nuclear energy will be dependent, as it has in the past, on advances in reactor materials. The reactor metallurgist recognizes this challenge and will continue to be at the forefront of achievement in this field which is "at the very frontier of the nature of matter itself".

Advancements in Wood Preservatives

Protecting wood against destructive biological attack is a continuing battle for scientists. One of the current bottlenecks in the development of new preservatives is the long period required to evaluate candidate materials. The authors review present evaluation methods, discuss improved techniques now under development, and point out some possible new approaches to wood preservation.

by JOSEPH E. BURCH *and* R. GLEN FULLER

WOOD IS ONE OF THE MOST useful of the construction materials available to us. In some of its important areas of usefulness, however, wood requires special protection to guard it against attacks by its natural enemies—fungi, insects, and certain marine animals. Properly protected, the material will stand up for centuries. Exposed unguarded to conditions that encourage biological attack, wood is likely to be destroyed in a relatively short time.

In the United States, as elsewhere, insects and wood-destroying fungi cause untold millions of dollars in damages each year to wood structures across the land. In the country's coastal waters, too, several types of marine organisms cause immense damage by boring

The damage caused by common destructive marine animals is shown in this full-size radiograph of a portion of a badly infested wood panel. The tear-drop shaped forms along the edges are pholads, or boring clams. The long winding burrows of the shipworm are seen throughout most of the panel, while portions of the right edge have been destroyed by the crustacean borer Limnoria.

into the interior of wood structures or chipping away at their surfaces. Biological attack is most severe in tropical regions, but no part of the United States or its coastal waters is free of wood-destroying organisms. In peacetime, the losses caused by these agents are mainly economic. In time of war, the loss of an important docking facility, warehouse, or communication line can have more drastic results. It is not surprising, then, that the search for cheaper or more effective methods of protecting wood from its biological enemies is constantly going on. Wood preservatives, the most effective means at present for foiling these enemies, are under constant study. Some of the problems encountered in protecting wood, some of the important preservative materials, and some of the methods used in research on the problem, are considered in this article.

Wood-Destroying Organisms

Wood-destroying organisms are mainly of three types, fungi, insects, and marine animals of various kinds. The wood-rotting fungi, *Lentinus lepideus*, *Lenzites trabea*, and *Poria monticola*, among others, and termites, wood-boring beetles, and carpenter ants, constitute the most important of the terrestrial wood-destroying agents. Wood exposed to sea water is subject to attack by molluscan shipworms (mainly species of *Teredo* and *Bankia*), pholads or boring clams, and a crustacean borer, *Limnoria*.

These widely divergent biological forms—insects, fungi, and marine animals—have some important characteristics in common. With a few exceptions they all attack and destroy wood by using the wood carbohydrates as a source of food. Being living organisms they are, to a degree, susceptible to the same types of toxic agents. These similarities explain why, for example, a wood preservative that gives effective protection against wood-rotting fungi will also usually protect it from termite or beetle attack.

On the other hand, wood-destroying organisms, like other forms of life, are capable of adaptation to highly adverse conditions, including the presence of toxic substances in their food supply. For example, wood that has been pressure impregnated with a creosote-coal tar mixture effectively resists attack by shipworm and pholads for long periods, even in heavily infested tropical waters. By contrast, *Limnoria* attack is not prevented by this treatment, though it is retarded to some extent.

Progress in wood-preservative development will require better understanding of a complex biological-physical system—the nature of the living organism against which protection is sought, the chemical and physical properties of wood itself, and the environment within which the wood is to be exposed. Similarily, methods for evaluating new preservatives must take all of these factors into account.

Methods of Protecting Wood

Basically, two methods are available for protecting wood from biological attack, (1) covering it with an impervious coating or (2) impregnating it with a toxic material. Each method has advantages and disadvantages, and there are many applications for which one method of protection is more suitable than the other.

Coatings

Painting is the most common way of applying a relatively impervious coating to a wood surface. This protective method is particularly suitable to surfaces that will not encounter abrasion or other stresses that will break the film, and that can be repainted when necessary. However, the paint film itself may be sub-

Research in wood preservatives has dominated Dr. Joseph Burch's research activities. His studies have included development of means for rapidly identifying mixtures of creosote and petroleum, accelerated toxicity evaluations of wood preservatives, and characterization of creosote, petroleum, and tar products. He has also been associated with the search for chemical uses for new and by-product materials of the chemical, lumber, and other industries. Prior to joining the Battelle staff, he was associated with the National Aniline Division of Allied Chemical where he participated in studies of vat dyes.

Glen Fuller, who for five years supervised Battelle's North Florida Research Station, has had a continuing interest in studies of the deterioration of wood and other materials in marine and subtropical terrestrial environments. He has also participated in research relating to the evaluation of chemical and pharmaceutical materials for agricultural use, the utilization of plants as metal accumulators, and the application of trace minerals to plant nutrition. Currently he is engaged in studies of such chemical agents as pesticides and growth regulators.

ject to biological attack or may be mechanically damaged by biological agents. This difficulty can usually be overcome by adding suitable toxicants to the paint, as has been demonstrated by commercial use of antifouling paint. Paints of this type, developed by Battelle and other laboratories, have proved valuable in protecting sea-going vessels. Their use increases the operating efficiency of such vessels by inhibiting the growth of barnacles and other fouling organisms, thus reducing the necessity for costly drydocking and overhauls.

Toxic preservatives, in aqueous or oil solutions, are sometimes applied to wood surfaces by brushing or dipping. Unless such treatments can be renewed periodically they are usually unsatisfactory. Since the layer of treated wood is relatively thin, it may be easily damaged and thus expose unprotected wood. Furthermore, the toxicant may evaporate or be leached from this thin layer, and there is no backlog of toxic materials in the wood to replenish the diminished supply at the surface.

Other coatings that may be applied to wood for protective purposes are either expensive or difficult to apply, or both. Thus, thin copper sheathing was applied to the hulls of ships in earlier times to protect them from marine organisms. Concrete casings have been used to protect marine pilings in recent years, but the pilings are difficult to encase in place, and it is costly to set a piling that has been previously encased in concrete. Furthermore, it may be necessary to protect the concrete casing from mechanical damage. There have been some recommendations in recent years that marine pilings be protected by sheathing them in plastic coatings. As with concrete coatings, it will be troublesome to encase the piling in position and equally hard to position an encased piling without damaging the casing. In addition, a plastic coating would be relatively thin and thus subject to mechanical breaching, and it would be difficult to make animal- and fungus-proof seams. This means of protecting wood from biological degradation is likely to be the most expensive of all treatments.

How wood piling looks in the last stage of a full-scale preservative evaluation. After eight years, the piling in the left foreground has deteriorated appreciably, while the one to the right has been practically destroyed by action of marine borers. The piling partly hidden by the one in the left foreground has been largely unaffected by borers during the same period.

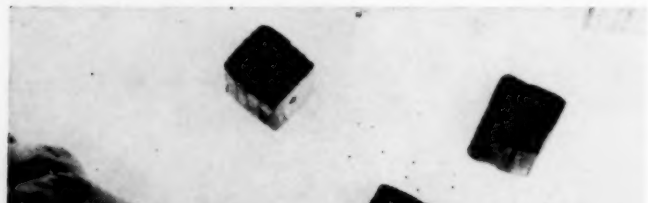
Impregnation

For those applications in which periodic maintenance of wooden members would be difficult and costly, impregnating the wood with a preservative before incorporating it into the structure appears to be the most practical means of protection. The two most common preservatives used for this purpose are coal-tar creosote and pentachlorophenol. These materials are used to a large extent in the protection of railroad ties, utility poles, and fence posts, and are being increasingly used in a relatively new type of structure, the pole building. Pentachlorophenol is also sometimes used in treating wood that will subsequently be given a decorative coating of paint. Creosote or mixtures of creosote and coal tar are used in the protection of marine structures, and mixtures of creosote and petroleum are usually used in the treatment of crossties. Certain other timbers which may be in close contact with the ground or with humid conditions, such as bridge timbers, sills and floorings of barns, warehouses, and freight cars, may also be impregnated with one or the other of these two preservatives.

Other preservatives, mainly water-soluble inorganic salts, are sometimes used for preserving wood against biological attack as well as to fireproof it, but the present use of these materials is relatively small. In 1957, creosote or creosote-coal-tar solutions accounted for 80 per cent of all treating materials used, pentachlorophenol accounted for about 13 per cent, and the

remaining 7 per cent included all other preservatives used.

Creosote and pentachlorophenol (which is commonly used in solution in a suitable petroleum solvent) are usually forced into the wood under pressure. This provides a thick layer of impregnated wood and establishes a reservoir of preservative to renew the protection at the surface as the preservative is slowly lost by evaporation or leaching. Moreover, this thick layer is less easily breached by mechanical accidents than a protective coating applied to the surface. The long-range protection provided by such treatment is particularly important for utility poles, railroad ties, marine pilings, fence posts, and other applications where periodic maintenance or replacement are difficult and expensive.



These wooden blocks, following treatment with preservatives, have been exposed to attack by wood-destroying fungi for 90 days. As compared with the almost perfect preservation of the block in the technologists's fingers, the others reveal the shrinkage, distortion, and discoloration associated with moderate attack. The latter blocks also suffered serious loss of weight and strength.

Both creosote and pentachlorophenol have disadvantages. Their odor generally makes them unsuitable for use in structures for human habitation. Creosote, if present in wood in sufficient quantity to be an effective preservative, is difficult to paint over. Pentachlorophenol, applied in a petroleum carrier, usually can be painted over successfully. However, it has the disadvantage of being subject to rapid leaching in sea water or in moist alkaline soil. Both preservatives are relatively effective against all of the common wood-destroying fungi, although some fungi are more tolerant to one than to the other. Some recent work in this country and abroad has shown that the preservative effect of the two in combination is greater than that of either of them alone.

Evaluation of Terrestrial Preservatives

Two criteria are of major importance when judging the potential value of a wood preservative—(1) toxicity to wood-destroying organisms and (2) duration of effectiveness. Of course, several other questions must be answered favorably if the candidate preservative is to be accepted commercially: Will it give protection in economical concentrations? Can it be applied conveniently? Is it safe for personnel? Does it produce side effects that will make its use objectionable? In general, the secondary questions will be answered while answers are being obtained for the major questions.

How does one go about finding out whether or not a material is toxic to wood-destroying organisms? The first step is to determine its toxicity to specific fungi. This can be done by learning if the material will inhibit the growth of such fungi on an agar plate. If inhibitory activity is found to be present, the material is then evaluated by means of the "soil-block" test.

In the second step, wood specimens (¾-inch cubes) are impregnated with known quantities of the candidate toxicant and allowed to condition under constant temperature and humidity long enough for the solvent to evaporate and the blocks to come to moisture equilibrium. They are then exposed to specific fungi for 90 days under controlled conditions of temperature and humidity. At the end of this period, the fungal growth is removed, the blocks are again conditioned to moisture equilibrium, and weight losses are determined. Blocks that have been given the same treatment, but held in sterile bottles instead of fungus-inoculated bottles during the period of attack, are used to determine operational losses (evaporation or leaching).

Data Analysis

Data analysis is the next step. If the operational losses are substracted from the total losses, the difference will be the losses due to fungal attack. A more meaningful way to handle the data is to plot both total losses and operational losses against preservative retention (usually expressed as pounds of preservative per cubic foot of wood). By this means it is possible to estimate the threshold retention for unweathered blocks, or the minimum retention (at the time of impregnation) at which the preservative affords protection against the fungus in question.

Taking into account the time required to prepare and condition the blocks and to evaluate the results, a soil-block assay requires about five months. A selective-solvent evaluation method has been developed at Bat-

telle that gives results that correlate well with initial toxicity of creosote and creosote-petroleum mixtures as judged by the soil-block assay. Moreover, it will give the answer within an hour. This method of evaluation requires more development, but it appears to be a real step forward in the meaningful evaluation of creosote preservatives.

Accelerated methods for evaluating the toxic effects of candidate preservatives against animals have not been developed to the extent that laboratory tests for fungicides have. In the case of termites, however, this has not been a particularly important shortcoming; materials that are effective as terrestrial fungicides have usually been effective against termites also.

Weathering Cycle

Once it is known that a material is toxic to wood-destroying organisms, technologists must determine how much of the material must be used to be effective, and how long the effectiveness will last. These two criteria usually go hand-in-hand, and can be evaluated simultaneously. For terrestrial preservatives the next evaluation step is to repeat the soil-block test, with the added feature of a weathering cycle prior to the fungal attack. A natural weathering cycle was formerly used, but this gave variable results, depending on the vicissitudes of the weather. The Forest Products Laboratory of the U. S. Department of Agriculture, Madison, Wisconsin, has developed an artificial weathering cycle which has the decided advantage of giving reproducible results. This method has reached the status of being a tentative American Society for Testing Materials (ASTM) method, and will probably be accepted as an ASTM method within a few years. The criticism may be offered that the results do not correlate with natural-weathering results, but the question may be asked, "Which natural-weathering results?" The best conclusion is that this artificial weathering procedure helps to remove one of the variables of a complex bio-assay.

If the threshold retention of the weathered preservative has been found to be low enough to indicate that practical and economical treatments are possible, the candidate should then be tried in an application that is closer to actual practice. This usually takes the form of a stake test, in which stakes are impregnated with known amounts of the preservative and the lower ends of the stakes are buried in the ground in natural surroundings. Periodically, usually once a year, the stakes are examined visually and with probes for evidence of biological attack. As such attack predominates near the ground line, it is necessary to disturb the natural environment every time the stakes are inspected. This departure from actual practice appears to be necessary, however, as no other valid means of inspection has yet been devised.

The most realistic means of evaluating the extent of biological degradation would be to measure the strength of the standing stakes, but this would require a device that would hold the stakes firmly at a point below the surface, again introducing a disturbance to the natural environment. Furthermore, natural variations in the strength of the wood specimens would necessitate the evaluation of a very large number of replicates, and this factor would greatly increase the variation in the natural environment by making necessary a very large plot of ground. All in all, it appears that the current method of evaluating stake-test data is a pretty good compromise. The stake test is not a highly accelerated one, but if the site of the stake plot is carefully chosen so that soil and environment favor rapid attack, trends can be indicated in one or two years. An effective preservative should afford protection to the stakes for eight to ten years.

In some cases, the stake-test data will be sufficient to warrant full-scale trials of the preservative in a commercial application. However, it is frequently advisable to subject the material to an intermediate evaluation, such as on posts. Utility companies like to have reasonable assurance that treated poles will last an average of twenty years, and railroad companies expect their treated crossties to last an average of thirty years. Consequently, they expect a preservative material to be proved as far as is practical before they are willing to gamble much money on its use.

Evaluation of Marine Preservatives

Generally speaking, the use of laboratory procedures for toxicity screening of marine preservatives has been limited. Marine organisms are not as easily grown in the laboratory as are fungi, although some marine laboratories have been making strides in this respect.

Most work in the evaluation of marine preservatives has been confined to studies in the native habitat and has been fraught with the inconsistencies of natural processes. The most commonly used method of making preliminary evaluations of marine preservatives consists of impregnating panels (nominally 1 x 3 x 18 inches) with known quantities of the candidate preservative and subjecting the panels to exposure in the sea. Replicates should be removed annually, scraped and inspected, and *not* be returned to the water. In some localities, such as Battelle's North Florida Research Station at Daytona Beach, Florida, an unprotected panel exposed in sea water will survive only one to three months. However, research at Battelle has

shown that it may require five to six years before realistic trends in the effectiveness of relatively good preservatives can be established. While this is an accelerated procedure, the degree of acceleration is far less than might be desired. Battelle is currently evaluating a method that appears to give realistic discriminations between preservatives within one to two years. Although far from being rapid, this is a considerable improvement over an exposure of five to six years.

There has been little practical development of means of screening materials for toxicity to marine organisms beyond that of subjecting treated panels to marine exposure. Yet this evaluation, by its very nature, also evaluates the materials for durability of their effectiveness in their actual service environment. Consequently, by the judicious or fortuitous choice of retention levels of the preservative in the panels, and the exposure of sufficient specimens, one may be able to learn in a single panel test not only if a material will afford marine protection, but also approximately what retention of preservative will be required. If, however, one were originally screening several materials for toxic effect, the odds are that the number of retentions and replications will not be sufficient to indicate clearly the minimum retention that will be required for satisfactory protection. In this case, it will be necessary to repeat the panel-exposure assay with the candidates that appear to have the most favorable balance of toxicity, durability, and economic promise. On the other hand, if the relatively rapid method of screening that was referred to earlier lives up to its initial promise, it appears possible to reduce by three to five years the time required for initial screening.

Once a marine preservative has shown good promise in the panel-exposure assay, and the retention required for durability of protection is reasonably well known, the next step is a big one. Full-scale pilings must be impregnated with the material to several levels both above and below the indicated safe retention level and installed in the same marine area. These pilings should be inspected annually by a diver, and the degree of biological degradation noted. This assay will usually require ten years or more. In most waters, if a preservative is not effective for at least ten years, it has little chance for commercial success. It might be pointed out that marine conditions such as exist at points along the Florida coast, are sufficiently severe that if pilings are still intact after exposure there for ten years, similarly treated pilings can be expected to survive for longer than ten years in many locations in the coastal waters of the United States.

Conclusions

The search for new or improved methods for protecting wood against biological attack is going on in many laboratories. There is unquestionably a need for improvement over existing preservatives, and the potential market for a more effective or more economical preservative is an attractive one. Progress may come from several directions; discovery of entirely new toxic agents; combining known toxicants, to take advantage of the best features of each; and improvement of application methods, to secure better retention of preservatives. There are certain trends in research related to wood preservation which may ultimately lead, directly or indirectly, to important advances.

For example, an increasing amount of research is being directed to the physiology of wood-destroying organisms. The selection of candidate chemicals for screening can benefit from such basic biological research. Each new insight into the mechanisms by which organisms break down and utilize wood creates new possibilities for chemical interference with these mechanisms, which in turn can lead to improved preservatives.

Attempts are also being made to take advantage of the chemical composition of wood itself, as the basis for more permanently fixing preservative toxicants in the wood. Some success has recently been reported for this approach. The process involves formation of a complex between copper, a toxic agent of proven effectiveness, and wood cellulose, thereby increasing the permanence of the preservative. Increased understanding of wood chemistry can lead to further advances in this direction.

Finally, there is a well-recognized need for reducing the time required to assess the effectiveness of new preservative treatments. As has been pointed out above, some progress is already being made along this line, and more may be anticipated. However, it would be misleading to leave the impression that evaluation of wood preservatives will ever become a simple or short-term process. At the present time, a wood preservative for terrestrial use would probably have to survive agar-plate, soil-block, stake, and post tests before most wood users would be willing to depend on it in actual practice. A marine preservative would have to survive one or two panel-immersion trials and one full-scale piling test before it would be acceptable. In either case, the elapsed time between the gleam in the producer's eye and commercial acceptance of his preservative is likely to be on the order of twenty years.

NOTES from BATTELLE

* URANIUM AND THORIUM ALLOYS

Data on the constitution of uranium and thorium alloys are of extreme importance to metallurgists working in atomic energy fields. As an aid to such technologists, Frank Rough and Arthur A. Bauer, both of Battelle, prepared a new reference work on the subject, *Constitutional Diagrams of Uranium and Thorium Alloys*. Like its predecessor, the work was written with the cooperation of technologists from the United Kingdom.

The book is divided into two major sections, uranium alloys and thorium alloys. In the major sections, following discussion of the base metal, the binary and the tertiary systems of each are treated in alphabetical order. The work contains data from both United States and United Kingdom sources. The authors acknowledge assistance from the staffs of both the U. S. Atomic Energy Commission and the United Kingdom's Atomic Energy Research Establishment. The book was recently issued by the Addision-Wesley Publishing Company, Inc. of Reading, Massachusetts.

* ULTRA-HIGH-PRESSURE RESEARCH

Although previous materials research has utilized both pressure and temperature independently, the combination of pressure and temperature provides a relatively new area for investigation.

Studies in this heretofore largely unexplored area of materials research are under way at Battelle. They are made possible by equipment designed to give a combination of ultra-high pressure and temperature.

To facilitate the Battelle studies, the latest of four high-pressure, high-temperature cells developed at the research center has just been completed. This newest cell will be capable of handling specimens up to one-fourth cubic inch in size. The other three cells, developed over a two-year period, have produced reactions at temperatures in excess of 5000 degrees Fahrenheit and at pressures in excess of one million pounds per square inch. The cells have been designed to operate at much greater pressures, and, operating at room temperature, they have provided pressure well in excess of two million pounds per square inch.

Commenting on the equipment, R. B. Fischer, chief of Battelle's Physical Metallurgy Division, said that it offers "exciting possibilities for extending the boundaries of research in metallurgy and associated fields". The equipment, he pointed out, provides a new tool for studying existing materials and for making new materials by forcing atoms into positions they are reluctant to take during conventional processing.

The high-pressure, high-temperature cells offer equally promising possibilities in other research. Dr. Charles M. Schwartz, chief of the Structural Chemistry Division, said that the equipment has already been used to investigate the effects of ultra-high pressure on insulators and semiconductors. Changes in the structure of many materials, he added, have already been effected through the use of pressure, and in at least one instance, a new form of matter has been obtained at Battelle.

* PLUTONIUM LABORATORY

Expanded research in fuel elements for reactors was underscored recently with Battelle's announcement of plans for a new laboratory designed especially for studies of plutonium.

The new laboratory, according to Dr. B. D. Thomas, Battelle's president, is going up at Battelle's Nuclear Research Center, outside Columbus, Ohio. Scheduled to be in operation by midsummer, it will be the first privately financed facility for the study of plutonium—generally conceded to be an important nuclear reactor fuel of the future. Research planned for the laboratory will center around applications of plutonium as a fuel in central station power reactors.

Of the three known fissionable materials, plutonium has heretofore received less attention as a reactor fuel than uranium-233 and uranium-235. Growing interest in plutonium at this time may be explained, in part, by the fact that it is now being produced in quantity as a by-product of uranium-fueled reactors, according to Dr. H. R. Nelson, manager of Battelle's atomic energy activities.

"In the rapid expansion of fuel element development facilities," states Dr. Nelson, "Battelle is anticipating the future research needs of government and industry. There is little doubt of the importance of plutonium as a reactor fuel. How quickly plutonium comes into

use in the United States will, of course, depend upon a number of technological and economic considerations. Outside the United States, there is also strong interest in plutonium. We feel that it is none too soon to begin a concentrated program of research on this material."

Battelle's new facility will be particularly well adapted to the study of plutonium as a reactor fuel material. This is a natural extension, says Dr. Nelson, of the Institute's work in reactor and fuel element metallurgy, which dates back to 1942. The facility will be utilized by both governmental and industrial groups. Research presently planned for the laboratory will focus on alloys and compounds of plutonium, as well as plutonium itself.

The new one-story plutonium laboratory building will provide 1440 square feet of space and will contain a variety of conventional and specialized equipment for the development of plutonium fuel elements. The research reactor, hot cells, and critical assembly laboratory in operation at Battelle's Nuclear Center will provide supporting services and facilities for specialists in the new plutonium laboratory.

* FEDERAL RESEARCH IN 1958

Federal government expenditures for scientific research and development in the fiscal year 1958 totaled about $3.4 billion. The figure reflects a 13 per cent increase over the $3 billion expended in 1957. It is one of the highlights of a report recently released by the National Research Foundation.

Eight agencies accounted for all but one per cent of the federal research and development budget. The Department of Defense and the Atomic Energy Commission were responsible for 83 per cent of the total. Sixteen per cent was accounted for by the Departments of Health, Education, and Welfare; Agriculture; Interior; and Commerce; and by the National Aeronautics and Space Administration (formerly National Advisory Committee for Aeronautics) and the National Science Foundation.

Almost 65 cents of every dollar for research and development was obligated for development. Of the approximately 35 cents remaining, "basic" research accounted for eight cents, "applied" research the rest.

Of the $1046 million obligated for basic and applied research in fiscal year 1958, the distribution was 64 per cent for the physical sciences, including engineering; 32 per cent for the life sciences; and 4 per cent for the social sciences.

Distribution of funds for research and development among organizations carrying on research showed 44 cents of each dollar being spent for work within the federal government; 38 cents to profit organizations, 15 cents to educational organizations; and 3 cents to "other" institutions.

* The *Refractories Bibliography* is a recently published listing of literature in the field that appeared during the years 1947 through 1956. It is a continuation of the *Refractories Bibliography, 1928 - 1947*. The new volume, containing more than 9500 references, was issued under the sponsorship of the Joint Refractory Committee of the Refractories Institute and the American Iron and Steel Institute. The references in the compilation relate to raw materials, manufacture, properties, and uses of refractories. Members of the Battelle staff who contributed to the planning and preparation of the bibliography were Adrian G. Allison, Robert W. Gibson, Jr., Bruce Jones, John D. Sullivan, and Do Lynn Welch.

Copies may be obtained from The American Ceramic Society, 4055 North High Street, Columbus, Ohio.

* *Newly appointed*—John K. Wetherbee, Chief, Systems Engineering Division, undertakes direction of the Division's varied program of research on automatic processing and control systems, including the design and development of digital and analog components and circuitry and special-purpose computer systems.

George H. Schippereit, Technical Adviser, Department of Metallurgy, now assumes responsibility for advising Battelle's metallurgical sponsors on the formation of their research programs.

William L. Swager, Assistant Manager, Department of Economics, will be concerned with the management of Battelle's varied program of research on problems in the fields of industrial economics, research planning, and operations research.

* Recent appointments of Battelle staff members to key technical posts include: *J. W. Clegg*, chairman, Program Steering Committee for 1960 Nuclear Congress, American Institute of Chemical Engineers; *F. D. Peterseim*, member, Committee on Use and Handling of Radioisotopes and High Energy Radiation, American Standards Association; *F. M. Stephens, Jr.*, member, Hydrometallurgy Committee, Extractive Metals Division, Metallurgical Society, American Institute of Mining, Metallurgical, and Petroleum Engineers.

Writings by STAFF Members

Journal of Organic Chemistry, v. 23, December, 1958, contains the following articles by staff members:

Mescaline Analogs. IX. Tetra- and Pentamethyl-β-phenethylamines. F. Benington, R. D. Morin, and Leland C. Clark, Jr., pp. 2034-2035.

Ring-substituted tetra- and pentamethyl-β-phenethylamines were all prepared by the same synthesis scheme as outlined by the following general equation, where Ar represents the appropriately polymethyl-substituted phenyl group: $ArH \rightarrow ArCH_2Cl \rightarrow ArCH_2CN \rightarrow ArCH_2CH_2NH_2$. This synthetic route was well suited to this series of compounds, since all of the starting tetra- and pentamethylbenzenes are commercially available or are readily accessible, and the chloromethylation reaction can give only one monochloromethyl product in each case.

Synthesis of *O*- and *N*-Methylated Derivatives of 5-Hydroxytryptamine. F. Benington, R. D. Morin, and Leland C. Clark, Jr., pp. 1977-1979.

Several new methylated derivatives of serotonin and bufotenine having potential physiological interest were prepared. Convenient syntheses of 1-methylbufotenine, 5-methoxy-*N*,*N*-dimethyltryptamine, and 1-methyl-5-methoxy-*N*-*N*-dimethyltryptamine from 5-benzyloxyindole are described.

Psychopharmacological Activity of Ring- and Side Chain-Substituted β-Phenethylamines. F. Benington, R. D. Morin, Leland C. Clark, Jr., and R. Phyllis Fox, pp. 1979-1984.

Synthesis of a number of ring-substituted-β-phenethylamines containing alkyl, halogen, and alkoxy substituents by various methods is described. The influence of these ring substituents on psychotomimetic activity of substituted β-phenethylamines was examined by observing the effect of these compounds on cat behavior.

"The Metal Thorium", American Society for Metals, Cleveland, Ohio, 1958, contains the following papers by staff members:

The Corrosion of Thorium and Its Alloys. W. E. Berry, R. S. Peoples, and H. A. Pray, pp. 267-276.

Discussion is primarily concerned with the behavior of the metal thorium and its alloys in contact with environments encountered in the several types of power reactors. The corrosion problems attendant upon the use of thorium oxide as a fuel are discussed briefly.

The Constitution of Thorium Alloys. F. A. Rough, Arthur A. Bauer, and H. A. Saller, pp. 316-351.

Thorium reacts readily with the atmosphere and with water at elevated temperatures. Since it is a very weak, ductile metal, alloying is important; unfortunately, the large atomic diameter of thorium restricts the number of systems in which extensive solid solutions are found. Available data are reviewed for 37 binary thorium systems.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

Influence of Mass Ratio on Displacement Cascades in Diatomic Solids. E. M. Baroody. *Physical Review*, v. 112, ser. 2, no. 5, December 1, 1958, pp. 1571-1576.

The effect on a cascade initiated when an atom of a solid of type AB receives considerable energy is investigated for a simple model. With some assumptions comparatively simple equations are obtained and solutions which are always approximately correct have been found by the Laplace transform method. The total number of displacements does not vary greatly with mass ratio.

Computers for Highway Engineering Program. Jack Belzer. *Computers and Automation*, v. 8, January, 1959, pp. 12-13.

Electronic computers are capable of relieving engineers of tedious computations and nonengineering responsibilities which are very time-consuming and costly. Standard routines can be set up for solution of problems in design of bridges and other structures, and subprograms written for different sequences of arithmetic operations. Programming would then constitute only the linkage statements which call for these subprograms. These linkage statements constitute a "compiler" language in which all programs could be written easily, rapidly, and accurately.

Thermodynamics of the Mercury Reduction of Titanium Tetrafluoride. John N. Blocher, Jr. and Elton H. Hall. *Journal of Physical Chemistry*, v. 63, January, 1959, pp. 127-128.

The reduction reaction was studied using triple-distilled mercury and titanium tetrafluoride which had been twice distilled in vacuum. Calculations indicate the difference $\Delta H^\circ_{f\ 298.2\ TiF_4(s)} - \Delta H^\circ_{f298.2\ TiF_3(s)} = 57.3\ (\pm 3)$ kcal.

Ultrasonic Defrosting of Frozen Foods. A. L. Brody and J. N. Antonevich. *Food Technology*, v. 13, February, 1959, pp. 109-112.

The relatively high energy requirements to achieve reasonable thawing rates in liquid foods and negligible effects in solid foods indicate inherent limitations of ultrasonic thawing. The use of ultrasonic energy to defrost frozen foods does not appears to be feasible because internal heating is difficult to realize, and existing equipment and power costs are not attractive in comparison with costs of conventional procedure.

Factors Influencing Isoimmunization in Rabbit. Effect of Early Postnatal Immunization on Specific Isoantibody Response. Carl Cohen. *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, December, 1958, pp. 607-610.

In a first systematic testing of the hypothesis of Mitchison, Brambell, and Owen that inhibition of antibody production may result from exposure of the fetus or newborn to incompatible homologous blood, it was shown that introducing incompatible whole blood into newborn rabbits can alter response of these animals to a later encounter with the same isoantigen. An initial 15 injections given from the day of birth decreased isoantibody production significantly, but not completely. Further injections effected complete inhibition of specific isoantibody production.

Designing With Brittle Materials. Winston H. Duckworth. *Materials in Design Engineering*, v. 49, January, 1959, pp. 82-85.

In designing with materials like ceramics, the problem of brittle failure must be taken into consideration. This factor can be minimized by increasing operating temperatures, applying loads slowly, increasing the ratio of shear-to-tensile stress, preventing stress concentrations, and replacing large members by several small ones. The designer should work closely with suppliers to obtain maximum desirable properties of materials.

Urgent Safety Problems Concerning Motor Vehicle Traffic Techniques. (In German.) **Dringliche Sicherheitsprobleme der Kraftverkehrstechnik.** R. Eberan v. Eberhorst. Reprint from *Automobiltechnische Zeitschrift*, v. 60, no. 11, November, 1958, pp. 1-10.

Although important progress has been made concerning the driving safety of the motor vehicle, a further field of research

(next page)

remains regarding the adaptation of the motor vehicle to man and to the natural limit of its requirements and efficiency. Accident statistics and their methodical application should be more closely oriented, as it is the case in the U. S., towards protection against accidents and their prevention. Describes a study of accidents using artificially produced collisions which pointed out safety demands for the motor vehicle constructor. The car of the Cornell University, U. S., is described in detail as an example of safety construction.

Higher Order Recurrences for Difference Equations. (In French.) **Récurrences d'ordre supérieur pour des équations aux différences.** Joseph Hersch. *Comptes rendus des séances de l'Académie des Sciences*, v. 246, January, 1958, pp. 364-367.

A general postulate in relation to discrete functions was developed; it satisfied every elementary case exactly. On the strength of it a second order recurrence allowed a calculation of the proper values of living membranes. In the case when the postulate was not satisfied, satisfactory approximate values were obtained.

The Flow of Steel in Runners and Gates. W. H. Johnson. Paper from "The Flow of Steel in Molds", pp. 48-70. 1958. Steel Founders' Society, Cleveland.

By means of an experimental mold design, the hydraulics of various gate-runners-sprue patterns were studied and an effective design was evolved from the data presented. Six essential points of design are enumerated for superior results.

Plastics. E. L. Kropa and E. E. McSweeney. *Industrial and Engineering Chemistry*, v. 51, January, 1959, pp. 36A-39A.

Important happenings in the plastics industry in 1958 are reviewed. Temporarily in oversupply in most of the best known lines of plastics, manufacturers have turned to more diversified products to expand their markets. Use of plastic materials in the building looks increasingly promising.

Synthesis of Pyromellitonitrile and Related Compounds. Emil A. Lawton and Donna D. McRitchie. *Journal of Organic Chemistry*, v. 24, January, 1959, pp. 26-28.

Pyromellitonitrile was prepared by the dehydration of pyromellitamide with thionyl chloride in dimethylformamide. The tetramide could not be dehydrated to the tetranitrile with acetic anhydride, phosphorus oxychloride, phosphorus pentachloride, or benzene-sulfonyl chloride. By-products of the thionyl chloride dehydration were 4,5-dicyanophthalimide, and 2,4,5-tricyanobenzamide. 2,5-Dibromoterephthalic acid reacted quantitatively with cuprous cyanide to form pyromellitimide, but dimethyl 2,5-dibromoterephthalate reacted under the same conditions to form dimethyl 2,5-dicyanoterephthalate. Tetrakis (N-ethyl) pyromellitamide reacted with phosphorus pentachloride to form N,N′-diethylpyromellitimide.

Foundries Can Produce Their Own Cast Iron Directly From Ore. H. W. Lownie, Jr. and A. J. Stone. *Modern Castings*, v. 34, January, 1959, pp. 47-54.

Foundries might increase their profits by using some recently developed direct-reduction processes for producing their iron. Some of these processes are suitable for integration into a foundry to replace the conventional cupola facilities and other melting auxiliaries. Under some conditions which exist in iron foundries today, these processes can be used to produce and melt iron more cheaply than by the present conventional methods. The use of direct-reduction processes would also reduce the foundry's dependence on outside sources of pig iron, scrap, and coke. The background of direct-reduction processes is given. Typical processes are described, and their advantages and disadvantages are discussed. Costs of producing iron by direct-reduction are summarized, and are compared with those involved in melting in a cupola.

Friction and Wear Properties of Titanium. P. D. Miller and J. W. Holladay. *Wear*, v. 2, no. 2, November, 1958, pp. 133-140.

Lubricants, with the possible exception of fluorocarbons, are ineffective in reducing the galling of bare titanium metal. Many of the wear problems have been minimized by coating the surface of the metal and then lubricating this surface. The wear resistance of the metal can be improved by oxide, nitride, and carbide case hardening and coatings. Chemical conversion coatings such as fluoride, phosphate, and anodized coatings help retain the lubricant and improve the resistance to galling. The most satisfactory procedure for preparing titanium surfaces for severe service is by the application of metallic coatings. Of the coatings tested, nickel has given the best results to date.

Cobalt and Its Alloys. F. R. Morral. 2nd Rev. Ed. 125 pp. 1958. Stoneman Press, Columbus, Ohio.

A summary of allotropy and phase diagrams for about 200 binary, ternary, and quaternary systems are presented or references are given. Numerous new supplmentary references are included.

Materials of Construction for Head-End Processes. Aqueous Reprocessing of Nuclear Fuels. Charles L. Peterson, Paul D. Miller, Earl L. White, and Walter E. Clark. *Industrial and Engineering Chemistry*, v. 51, January, 1959, pp. 32-37.

Laboratory studies of gas- and liquid-phase reactions show that tantalum, titanium, molybdenum, nickel, the Hastelloys, Inconel, Haynes 25, Type S-816, and Illium R are promising materials of construction, depending on the route chosen for the Zircex process. Unalloyed titanium may fill all construction requirements in the Darex process.

Applications of Infrared Spectroscopy in the Analysis and Chemistry of Varnish. (In German.) **Anwendungen der Infrarot-Spektroskopie in der Lack-Analyse und Lackchemie.** A. Reuter. Reprint from *Farbe und Lack*, v. 65, January, 1959, pp. 25-36.

A series of examples are given of how IR methods are applied by Battelle Institute to qualitative and quantitative analyses of raw materials, solvents, and varnishes. Investigations of varnish reactions are described, such as the hardening of alkyderesins and polyisocyanates, and incomplete polymerization processes. IR spectra are also used in studies of thermal stability.

Determination of Elementary Carbon in Dirt Mixtures. (In German.) **Die Bestimmung von elementarem Kohlenstoff in Schmutzgemischen.** G. Walter. *Wascherei-technik und -chemie*, v. 11, no. 11, 1958.

Describes a method of differentiating between the real carbon content of dirt and the carbon content of some carbon-containing substances present in dirt, such as carbonates and organic compounds. The dirt specimen is centrifuged and washed several times with acetone in order to eliminate soluble organic substances, especially hydrocarbons. The acetone is replaced by diluted nitric acid and the latter by concentrated nitric acid. The tube containing the specimen is then heated up to 90-100 C for about ½ to 1 hour until the nitrous oxide formation has subsided. After cooling, the residue is washed twice with 5 per cent nitric acid, and then with 5 per cent soda lye. Then the tube content is heated up for ½ hour up to 90 and 100 C with 25 per cent soda lye. After cooling, the residue is washed first with 5 per cent soda lye, then thrice with 5 per cent hydrochloric acid, and finally dried at 105 C. The weighed residue is thoroughly mixed and its carobn content is determined by the usual combustion method.

Significant Trends for Printing Production. J. Homer Winkler. *Photoengravers Bulletin*, v. 48, no. 5, December, 1958, pp. 11-16.

The impact of new developments on the industry are considered. The author emphasizes that the Graphic Arts Industry is not investing the percentage of the sales dollar in research that it should. A major portion of the research and development tab in the printing industry is being picked up by customers and by equipment and supply manufacturers. To achieve the optimum results from research efforts for all units of the industry, Graphic Arts management must include a research investment in future budgets.

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AERONAUTICAL ENGINEERING

3675 The Occurrence and Avoidance of Midair Collisions. Concludes that the greatest danger results from encounters between pairs of aircraft where at least one is in VFR flight. ***Seymour J. Deitchman.*** *Aero/Space Engineering*, v. 18, Jan. 1959, p. 53-60.

3676* Optics Aid Reliability. Describes missile tracking and recording devices which provide accurate information on launching and any malfunctions during flight. ***George A. Economou.*** *Aircraft and Missiles Manufacturing*, v. 2, Jan. 1959, p. 6-9.

3677* Non-Rigid Airships. Design and construction details reveal weight distribution is essential for supporting huge loads on fabric shell. ***John Kevern.*** *Aircraft and Missiles Manufacturing*, v. 2, Jan. 1959, p. 34-37.

3678 Aerodynamic Influence Coefficients for Delta Wings in Steady Supersonic Flow. A method of numerical integration using panels bounded by Mach lines. ***D. E. Lees.*** *Aircraft Engineering*, v. 31, Jan. 1959, p. 9-12.

3679 Characteristics of Slender Wing-Body Combinations With Folding Wings. A method of computing aerodynamic loads on slender bodies of complicated cross-section. ***George S. Campbell.*** *Aircraft Engineering*, v. 31, Jan. 1959, p. 13-20.

3680* General Variational Theory of the Flight Paths of Rocket-Powered Aircraft, Missiles and Satellite Carriers. A basic theory is presented for analyzing optimum flight paths. ***Angelo Miele.*** *Astronautica Acta*, v. 4, no. 4, 1958, p. 264-288.

3681 Effect of Uniformly Distributed Roughness on Turbulent Skin-Friction Drag at Supersonic Speeds. An experimental program was carried out in the 18-in. by 20-in. supersonic wind tunnel of the Jet Propulsion Laboratory to determine the effect of uniformly distributed sand-grain roughness on the skin-friction drag of a body of revolution for the case of a turbulent boundary layer. The Mach Number range covered was 1.98 to 4.54, and the Reynolds Number varied from about 3×10^6 to 8×10^6. Some data were also obtained at a Mach Number of 0.70. At speeds up to a Mach Number of 5 and for roughness sizes such that the quadratic resistance law holds, the compressibility effect is indirect, and the skin-friction drag is a function of only the roughness Revnolds Number, exactly as in the incompressible case. It is shown that the entire compressibility effect is a reduction of the fluid density at the surface as the Mach Number increases. ***Frank E. Goddard, Jr.*** *Journal of the Aero/Space Sciences*, v. 26, Jan. 1959, p. 1 + 15 pages.

3682 Aluminum in Missiles. Reviews most of the missiles in production for the Military of the United States. Reveals the expanding use of Al. *Light Metal Age*, v. 16, Dec. 1958, p. 8-11.

3683 Lunik Becomes Solar System's Tenth "Planet". Indications are Russians may have hoped to hit moon; the exploit demonstrates considerable know-how in velocity and guidance. ***Norman L. Baker.*** *Missiles and Rockets*, v. 5, no. 2, Jan. 12, 1959, p. 21.

3684 USSR Lunar Probes Will Orbit Close to Surface. Soviet Union's plans for future inspection of the moon's surface. ***John A. Fahey.*** *Missiles and Rockets*, v. 5, no. 2, Jan. 12, 1959, p. 22.

3685* Aeroelasticity—Retrospect and Prospect. Historical review of problems and developments. Predicts increasing importance in future design of high-speed aircraft. ***A. R. Collar.*** *Royal Aeronautical Society, Journal*, v. 63, Jan. 1959, p. 1-15.

3686* The Application of Automatic Digital Computers to Aeronautics. Describes methods of programming and solving of some aeronautical programs by the application of automatic digital computers. ***S. H. Hollingdale.*** *Royal Aeronautical Society, Journal*, v. 63, Jan. 1959, p. 51-56.

3687* The Materials Used in Aeronautics. Properties of the metals used for airplanes, at speeds up to the heat barrier, for airplanes and engines subjected to kinetic heating, and for ballistic missiles. (*In French.*) Les matériaux utilisés en aéro-

nautique. ***R. Lachenaud.*** *Technique et Science Aéronautiques*, 1958, no. 3, June, p. 91-99.

3688* Fatigue Behavior of Transport Airplanes. A study of fatigue phenomena and comparison of test pieces assembled by means of various types of rivets. Prevention of fatigue failure. (*In French.*) Tenue a la fatigue des avions de transport. ***J. Dor.*** *Technique et Science Aéronautiques*, 1958, no. 3, June, p. 109-121.

See also: **4289** (nuclear combustion plasmas for jet propulsion); **4774** (air conditioning of missiles); **4784** (astronautical test chamber specs).

AGRICULTURE

3689* Pesticides for '59. Contains discussion on: Dibrom, Glyodin, Cyprex, Phosphamidon, Herbisan, Terraclor, Trolene, Sytam, PRD experimental Nematocide, Dimethoate, 2,3,6-T. *Agricultural Chemicals*, v. 14, Jan. 1959, p. 28 + 3 pages.

3690* Microbial Control of Insects. Outlines advantages and disadvantages of microbial control of insect pests. *Bacillus thuringiensis* is expected to provide control of the alfalfa caterpillar with applications of 1 to 2 ounces of high potency material per acre; the cabbage looper with 2 lb. per acre. ***Irvin N. Hall.*** *Agricultural Chemicals*, v. 14, Jan. 1959, p. 45 + 3 pages.

3691 The Influence of Gibberellic Acid on the Growth and Alkaloid Biogenesis in *Datura stramonium Linné* and in *Atropa belladonna* Linné. *Gordon M. Smith and Leo A. Sciuchetti.* *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, Jan. 1959, p. 63-68.

3692* Nodulation Studies in Legumes. II. The Influence of Various Environmental Factors on Symbiotic Expression in the Vetch (*Vicia sativa* L.) and Other Legumes. *J. S. Pate.* *Australian Journal of Biological Sciences*, v. 2, no. 4, Nov. 1958, p. 496-515.

3693* The Electrophoretic Analysis of Plant Virus Preparations. Successfully used for the resolution of tobacco mosaic virus and potato virus X infection, the separation of radioactive metabolic intermediates, and the location of serologically active compounds. ***P. M. Townsley.*** *Canadian Journal of Biochemistry and Physiology*, v. 37, Jan. 1959, p. 119-126.

3694* The Chemistry of Tea and Its Fermentation. General analysis of black tea. Composition of chatechin mixture. Different contents of Japanese and North Indian teas. Conditions of fermentation and new substances. (*In German.*) Über die Chemie des Tees und der Tee-Fermentation. ***K. Herrmann.*** *Fette, Seifen, Anstrichmittel*, v. 60, Oct. 1958, p. 963-966.

3695* Disease-Producing Protozoa in Species of *Trogoderma*. *F. O. Marzke and R. J. Dicke.* *Journal of Economic Entomology*, v. 51, no. 6, Dec. 1958, p. 916-917.

3696* Rearing *Sitona hispidula* Larvae for Various Research Uses. Description of a method for rearing large numbers of larvae of the clover root curculio, for studies throughout the winter and spring months: procedure, providing food for the larvae and adults, obtaining and storing the adults, collecting eggs in a special oviposition chamber, incubating eggs and preparing the soil in potted plants for rearing larvae. ***R. C. Newton.*** *Journal of Economic Entomology*, v. 51, no. 6, Dec. 1958, p. 917-919.

3697* Microbiological Synthesis of Fat. The Influence of Phosphate Concentration on the Metabolism of *Penicillium lilacinum* Thom in Surface Culture on a Sucrose Medium. A study of the influence of phosphate at two levels, in conjunction with two ratios of carbon to nitrogen in the media, in order to determine how the proportions of fat, protein, and carbohydrate in the mycelium were affected as growth proceeded. ***Kaiser Naguib and Thomas Kennedy Walker.*** *Journal of Experimental Botany*, v. 9, no. 27, Oct. 1958, p. 426-429.

3698 The Nation's Plant Food Larder. The history of the use of fertilizers in the U.K. is discussed, and future prospects for increases in the use of fertilizer are examined. ***G. W. Cooke.*** *Journal of the Science of Food and Agriculture*, v. 9, Dec. 1958, p. 761-772.

3699* The Toxic Hazard Associated With Continuous-Flow Heat-Volatilized Insecticidal and Acaricidal Aerosols. *A. Howard Baker, G. F. H. Whitney, and Alastair N. Worden.* *Laboratory Practice*, v. 8, Jan. 1959, p. 3 + 8 pages.

3700 Resistance to Pyrethrins and to Pyrethrins - Piperonyl Butoxide in a Wild Strain of *Musca domestica* L. in Sweden. The resistant strain was 12.5 times more resistant to pyrethrins, and 10.7 times more resistant to pyrethrins plus piperonyl butoxide, than the normal laboratory strain. Resistance to the knock-down effect of these insecticides was also shown. ***M. Davies, J. Keiding, and C. G. von Hofsten.*** *Nature*, v. 182, Dec. 27, 1958, p. 1816-1817.

3701* A New Viral Disease of Tomato and Pepper. The virus, tomato atypical mosaic virus (TAMV) is inactivated in 10 minutes at 72 C, is unstable to freezing and thawing, does not infect certain varieties of beans susceptible to tobacco mosaic virus (TMV), does not cross-protect against TMV in tomatoes, and under field conditions induces symptoms in tomato and pepper unlike those from TMV. ***P. M. Miller and H. H. Thornberry.*** *Phytopathology*, v. 48, Dec. 1958, p. 665-670.

3702* Influence of 2,4-Dichlorophenoxyacetic Acid on Solute Uptake by Chlorella. With low concentrations of 2,4-D the uptake of sucrose, mannitol, and PO_4 is greater in treated cells than in untreated ones, while an increase in 2,4-D concentration results in a progressive decrease in permeability, as indicated by inhibition of solute uptake. ***Randolph T. Wedding, Louis C. Erickson, and M. Kay Black.*** *Plant Physiology*, v. 34, no. 1, Jan. 1959, p. 3-10.

3703* A Discussion on the Physiology and Biochemistry of Lactation. Areas covered include: hormonal synergism in mammary growth; pituitary and milk secretion; central nervous system, neurohypophysis and milk ejection; biosynthesis of lactose; precursors of the proteins of milk; the origin of milk fat; and fatty acid synthesis. ***S. J. Folley, et al.*** *Royal Society, Proceedings*, v. 149, ser. B, Dec. 17, 1958, p. 301-424 + 3 plates.

3704 Reappraisal of the Soil. Exogenic excitation, oxidation, carbonation, and hydration. Migration of carbon as example of the general trend of the migration of elements through the soil. Soil evolution. The situation of pedogenesis today. ***C. C. Nikiforoff.*** *Science*, v. 129, Jan. 23, 1959, p. 186-196.

3705 The State of World Agriculture. Summary of the report to the FAO Council, *The State of Food and Agriculture*, 1958. *World Crops*, v. 11, Jan. 1959, p. 5-10.

BIOCHEMISTRY AND BIOPHYSICS

3706 Advances in Protein Chemistry. Immunochemical methods in studies on proteins, protein-carbohydrate complexes, silk fibroins, and synthesis and chemical properties of poly-α-amino acids. ***C. B. Anfinsen, Jr., Kenneth Bailey, M. L. Anson, and John T. Edsall, editors.*** v. XIII. 525 pp. 1958. Academic Press, New York. (QD431 Ad95 Vis.)

3707* Frozen Men for Mars. A review of papers presented at the British Interplanetary Society's space medicine symposium held in October 1958. Subjects discussed included: man-machine systems; G loadings during take-off; sensory impoverishment, confinement, and sleep deprivation, weightlessness and suspended animation for long space trips. *Aeronautics*, v. 39, no. 5, Jan. 1959, p. 42-44.

3708* On the Qualitative Heterogeneity of Ribonucleic Acid in Animal Cells. (*In Russian.*) O kachestvennoĭ geterogennosti ribonukleinovoĭ kislotv i zhibotnykh kletkakh. ***V. Ia. Brodskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 3, Nov. 21, 1958, p. 546-549.

3709* Induction of Controlled Hereditary Variations in *Drosophila melanogaster*. (*In Russian.*) Vyzyvanie napravlennykh nasledstvennykh izmeneniĭ i *Drosophila melanogaster*. ***S. M. Gershenzon and I. A. Kiseleva.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 3, Nov. 21, 1958, p. 554-557.

3710* On the Identity of Histaminase and Diaminoxidase. (*In Russian.*) Ob identichnosti gistaminazy i dinaminoksidazy. ***E. V. Goriachenkova.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 5, Dec. 11, 1958, p. 898-901.

3711 Photochemistry of Nucleic Acids and Related Compounds. I. The First Step in the Ultraviolet Irradiation of 1,3-Dimethyluracil. ***Shih Yi Wang.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6196-6198.

3712 Studies on Polynucleotides. I. A New and General Method for the Chemical Synthesis of the C_5'-C_3' Internucleotidic Linkage. Syntheses of Deoxyribodinucleotides. ***P. T. Gilham and H. G. Khorana.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6212-6222.

3713 Immunochemical Studies on Blood Groups. XX. The Effects of *Clostridium tertium* Enzymes on Blood Group A, B and O(H) Substances and on Type XIV Pneumococcal Polysaccharide. ***Calderon Howe, Gerald Schiffman, Ada E. Bezer, and Elvin A. Kabat.*** *American Chemical Society, Journal*, v. 80, Dec. 20, 1958, p. 6656-6661.

3714* Growth and Organized Development of Cultured Cells. III. Interpretations of the Growth From Free Cell to Carrot Plant. ***F. C. Steward.*** *American Journal of Botany*, v. 45, no. 10, Dec. 1958, p. 709-713.

3715* Protein Synthesis and the Control of Plant Processes. Recent literature indicates that microsomal ribonucleoprotein particles in the cytoplasm of plant, animal, and microbial cells alike, possess the function of protein synthesis, and appear to be responsible for the formation of many, perhaps all, of the soluble cytoplasmic proteins. To the process the microsome contributes information, arranging previously acyl-activated amino acid residues in the abundance and sequence characteristic of the specific enzyme being synthesized. The microsome consists of RNA and of structural protein, common to microsomes and not directly related to the protein synthesized by the microsome. The amount of information contained in the RNA of a microsomal particle can be calculated to be sufficient for the synthesis of one or at the most a few species of protein molecules. Microsomal RNA, and possibly microsomal protein also, appear to be synthesized within the nucleus. ***James Bonner.*** *American Journal of Botany*, v. 46, no. 1, Jan. 1959, p. 58-62.

3716 Computers in Medicine and Biology. ***Harry Weinrauch and Albert W. Hetherington.*** *American Medical Association, Journal*, v. 169, no. 3, Jan. 17, 1959, p. 240-245.

3717* Studies on the Amino Acid Sequence of Tobacco Mosaic Virus (TMV) Protein. I. Fractionation of Products of Tryptic Hydrolysis by Countercurrent Distribution. Nine apparently major tryptic hydrolysis products containing arginine and one containing lysine have been obtained from this fractionation. ***Duane T. Gish, L. K. Ramachandran, and W. M. Stanley.*** *Archives of Biochemistry and Biophysics*, v. 78, no. 2, Dec. 1958, p. 433-450.

3718* Phosphorus Content of Tobacco Mosaic Virus. The phosphorus content of 19 samples of tobacco mosaic virus was found to average 0.45%. Ten nucleic acid preparations obtained from the virus were found to contain an average of 8.3% phosphorus, and analyses on three of the preparations indicated that they contained about 5.2% sodium. From these values it can be calculated that tobacco mosaic virus has about 5.1% nucleic acid. ***C. A. Knight and B. R. Woody.*** *Archives of Biochemistry and Biophysics*, v. 78, no. 2, Dec. 1958, p. 460-467.

3719* Antibiotics as Tools for Metabolic Studies. I. A Survey of Toxic Antibiotics in Respiratory, Phosphorylative and Glycolytic Systems. ***Henry A. Lardy, Diane Johnson, and W. C. McMurray.*** *Archives of Biochemistry and Biophysics*, v. 78, no. 2, Dec. 1958, p. 587-597.

3720* Cell Changes During Protein Synthesis and Secretion: An Electron Microscopic Study of the Response of Lymphoid Tissue to Antigenic Stimulus. ***H. J. Hoffman and G. W. Grigg.*** *Australian Journal of Biological Sciences*, v. 2, no. 4, Nov. 1958, p. 557-570 + 8 plates.

3721* Simulation of Genetic Systems by Automatic Digital Computers. III. Selection Between Alleles at an Autosomal Locus. IV. Selection Between Alleles at a Sex-Linked Locus. ***J. S. F. Barker.*** *Australian Journal of Biological Sciences*, v. 2, no. 4, Nov. 1958, p. 603-625.

3722* Animal Cells and Microbiology. A review of the nutritional requirements and metabolic activity of human and animal cells in cultures. A total of only 28 defined growth factors (13 amino acids, 8 vitamins, 6 ions, and glucose) supplemented with serum proteins, have so far proved adequate for the cultivation of all of the human cell lines examined; and a total of 32 factors provide for the sustained propagation of every mammalian cell strain so far isolated. ***Harry Eagle.*** *Bacteriological Reviews*, v. 22, no. 4, Dec. 1958, p. 217-222.

3723* Cellular Aspects of the Cell-Virus Relationship. Formulates a time schedule of events correlating the metabolic activity and gross morphologic alterations with viral synthesis. ***W. Wilbur Ackermann.*** *Bacteriological Reviews*, v. 22, no. 4, Dec. 1958, p. 223-239.

3724* Irradiation of the Entire Body and Marrow Transplantation: Some Observations and Comments. Case reports of five patients with acute leukemia receiving total-body irradiation and intravenous infusion of normal marrow are presented. ***E. Donnall Thomas, Harry L. Lochte, Jr., and Joseph W. Ferrebee.*** *Blood*, v. 14, Jan. 1959, p. 1-23.

3725* The Response of Eosinophils to Total-Body X-Radiation of the Monkey. Circulating levels of eosinophils in the monkey have been followed before and after total-body exposure to a near median-lethal dose of x-radiation. Eosinophils are moderately decreased during the first three days and strongly depressed in the second and third weeks. During the fourth week these cells rapidly reappear, and an absolute and relative eosinophilia ensues which is maximal at the fifth to seventh week. ***Earl Eldred.*** *Blood*, v. 14, Feb. 1959, p. 187-193.

3726* Acquired Tolerance to Homologous Transplantation of Endocrine Glands in Inbred Strains of Mice. . . . has been achieved by the intravenous injection during the neonatal period of homologous living spleen cells taken from adult mice of the same strain as the prospective donors of the endocrine glands. In the immunologically tolerant host the homotransplanted glands retained their functional endocrine activity as well as anatomical integrity. *British Journal of Experimental Pathology*, v. 34, no. 6, Dec. 1958, p. 574-581 + 1 plate.

3727* Interference by Endotoxic Polysaccharides With Inactivation of Coliphage by Human Serum. The inactivation of coliphage T2r$^+$ by the properdin system in human serum may be counteracted by microgram levels of those polysaccharides which elicit endotoxic reactions in the mammalian host. Under appropriate conditions of test, the antiviral action of properdin was annulled by polysaccharide as a linear function of dose. ***M. Landy, R. J. Trapani, and M. J. Shear.*** *British Journal of Experimental Pathology*, v. 34, no. 6, Dec. 1958, p. 618-630.

3728* *In Vitro* Production of Diphtheria Antitoxin by Tissues of Immunized Animals. III. Incorporation of Amino Acids Into Antibody; Relationship to Antibody Synthesis and Sensitivity Relative to Other Methods. ***A. B. Staritsky.*** *British Journal of Experimental Pathology*, v. 34, no. 6, Dec. 1958, p. 661-673.

3729* Nuclear Proteins of Tumors and Other Tissues; A Review. A comprehensive summary of research on lipo-proteins, globulins, "arginine-rich" histones, and "lysine-rich" histones. ***Harris Busch and Joseph R. Davis.*** *Cancer Research*, v. 18, no. 11, Dec. 1958, p. 1241-1256.

3730* *In Vivo* and *in Vitro* Studies of the Action of Guinea Pig Serum Against the Ascites Form of the Murphy-Sturm Lymphosarcoma. Guinea pig serum is effective in inhibiting the ascites form of the Murphy-Sturm lymphosarcoma in Wistar rats. Sera both from adult and newborn animals con-

tain agglutinins against erythrocytes, but only the serum from adults contains hemolysins. Sera from both adult and newborn animals contain agglutinins for the tumor cells. Absorption experiments indicate that the agglutinins to the erythrocytes and tumor cells are distinct from one another. ***H. Ainis, et al.*** *Cancer Research*, v. 18, no. 11, Dec. 1958, p. 1309-1313.

3731* Problems in Experimental Tumorigensis of the Pituitary Gland, Gonads, Adrenal Cortices, and Mammary Glands: A Review. *Kelly H. Clifton.* *Cancer Research*, v. 19, no. 1, Jan. 1959, p. 2-22.

3732* Pathogenesis of Tumor Invasion. I. Interaction Between Normal Tissues and "Transformed" Cells in Tissue Culture. Various patterns of invasion were obtained according to the combination of normal human tissues with malignant "transformed" cells, or with continuous lines of cells (HeLa, KB, J-96) and according to the connective tissues involved. D-189, the more invasive of two cells of normal derivation, was much more motile than conjunctiva. ***Joseph Leighton, Richard L. Kalla, Ira Kline, and Morris Belkin.*** *Cancer Research*, v. 19, no. 1, Jan. 1959, p. 23-27 + 3 plates.

3733 Steroid Hormones: Playing for Top Place in the Drug Market. A study of the production and marketing of steroids as anti-inflammatory agents (corticosteroids), progestational agents and sex hormones. Lists major areas of application and most important steroids for those areas. ***Norman Applezweig.*** *Chemical Week*, v. 84, no. 5, Jan. 31, 1959, p. 38-52.

3734* Quantitative Cytophotometric Determinations of Deoxyribonucleic Acids in Somatic Cells Treated *in vivo* by Means of Neutral Deoxyribonuclease. The deoxyribonucleic acid content of the nuclei at rest was not modified. The mitotic activity was reduced almost entirely, yet a certain preprophasic synthesis of the deoxyribonucleic acid continues to take place. (*In French.*) Dosages cytophotométriques d'acides désoxyribonucléiques dans des cellules somatiques traitées vivantes par de la désoxyribonucléase neutre. ***Maurice Chèvremont, Simone Chèvremont-Comhaire, and Edgard Baeckeland.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 23, Dec. 10, 1958, p. 2197-2200.

3735* Teratogeneous Effects of Actinomycin on Rats. The intraperitoneal injection of 10 μg of actinomycin D on the 7th, 8th, and 9th days of gestation, in a female rat, causes 30% of abortions and fetal abnormalities. Among the living fetuses, 28% exhibit visible malformation. (*In French.*) Sur l'activité tératogène chez le rat de l'actinomycine. ***Herbert Tuchmann-Duplessis and Lucette Mercier-Parot.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 23, Dec. 10, 1958, p. 2200-2203.

3736* Antidotal Capacity of Certain Filtrates of the Culture of Germs That Are or Are Not Antagonistic to Streptolysin. Filtrates of *B. subtilis*, S. *griseus* and *P. notatum* cultures are antidotal against streptolysin and staphylolysin. *P. aeruginosa* and *Proteus* filtrates have no effect on staphylolysin and are only slightly antidotal against streptolysin. (*In French.*) Sur le pouvoir antidotique de certains filtrats de culture de germes antagonistes ou non, vis-a-vis de la streptolysine. ***Rémy Richou and Henry Richou.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 23, Dec. 10, 1958, p. 2226-2228.

3737* The Inhibition of Cancers Grafted on Mice by Means of Microbial Product Injection. Typhus endotoxin (somatic antigen of a "smooth" strain of *Salmonella typhi*) prevents the growth of grafted tumors, without exhibiting any toxicity, in mice treated with cortisone. Similar effects, with or without cortisone, are produced by the acid-soluble extract of a "rugose" ("rough") mutant of *S. typhi* (strain R2). (*In French.*) Inhibition de cancers greffés à des souris par l'injection de produits microbiens. ***Louis Chedid, Georges Rudali, Fernand Boyer, and Monique Parant.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 25, Dec. 22, 1958, p. 2501-2504.

3738 Enzymes. Biochemical Jet Stream. The uses of enzymes and the trade marked enzyme products. Effects of enzyme actions or deficiencies on the human body. Definition, main characteristics, coenzymes, purification; future prospects. ***Charles E. Dutchess.*** *Drug and Cosmetic Industry*, v. 84, no. 1, Jan. 1959, p. 25 + 7 pages.

3739 How Electronics Controls Depth of Anesthesia. Automatic controls continuously monitor border-of-wakefulness of patient who is undergoing a surgical operation. Servo-driven system supplies anesthetic at a fixed level, proportional to the cortical activity of the brain. ***J. Weldon Bellville and G. M. Attura.*** *Electronics*, v. 32, no. 5, Jan. 30, 1959, p. 43-45.

3740* The Influence of the Anterior Hypophysis on the Morphology and Function of the Adrenal Cortex *in Vitro*. Even after a culture period of 12 days explants of the anterior hypophysis were able to elicit typical morphological changes in explants of adrenal cortical cells and to stimulate corticosteroid production. ***A. Schaberg and C. A. de Groot.*** *Experimental Cell Research*, v. 15, no. 3, Dec. 1958, p. 475-483.

3741* Alpha Irradiation of Parts of Single Cells in Tissue Cultures. I. Techniques. II. Dosimetry. Techniques are described for making tungsten micro-needles with polonium deposited over a length of 5-10 microns of their tips, and for covering this polonium with a layer of chromium 2-6 microns thick. Because of the sharply defined range of the alpha particles emitted by the polonium, these micro-needles could be used to irradiate parts of single cells in tissue cultures. A method for measuring the dose rate of alpha radiation at points near one of these micro-needles, when it is immersed in a liquid tissue culture medium, is also outlined. ***T. R. Munro.*** *Experimental Cell Research*, v. 15, no. 3, Dec. 1958, p. 529-550.

3742* Localization of Nucleus-Specific Protein as Shown by Transplantation Experiments in *Amoeba proteus*. A nucleus from a labelled cell grafted into an unlabelled cell that had not been enucleated showed that the label leaves grafted nucleus to an appreciable extent and appears mainly in the originally unlabelled nucleus. This suggests that a nuclear protein migrates from nucleus to cytoplasm, remains there briefly, and shortly returns to the nucleus. ***L. Goldstein.*** *Experimental Cell Research*, v. 15, no. 3, Dec. 1958, p. 635-637.

3743* The Cellular Transformation of Injected Colloidal Iron Complexes Into Ferritin and Hemosiderin in Experimental Animals. A Study With the Aid of Electron Microscopy. A study of the changes in the fine structure of intracellular deposits of injected iron compounds in several types of cells in mice and rats at various intervals following intraperitoneal injection. Comparison of the physico-chemical nature of the intracellular material with that of the iron compounds prior to their injection. Presence of ferritin in relation to deposits of injected iron compounds. Association of these compounds with cytoplasmic organelles. ***Goetz W. Richter.*** *Journal of Experimental Medicine*, v. 109, Feb. 1959, p. 197-214 + 9 plates.

3744* The Release and Stability of the Large Subunit of DNA From T_2 and T_4 Bacteriophage. The large subunit of DNA (molecular weight 45×10^6) found for each former phage particle, is sensitive to very small amounts of DNAase, and is resistant to mixed proteases and cannot be dispersed by banding in cesium chloride density gradients. ***Charles A. Thomas, Jr.*** *Journal of General Physiology*, v. 42, no. 3, Jan. 1959, p. 503-523.

3745* The Toxic Effect of Vaccinia Virus on Leucocytes *In Vitro*. Cytopathic changes were not caused by virus multiplication but by a toxic principle which could not be separated from the virus particles by centrifugation. Virus preparations made noninfective by irradiation with ultraviolet light still possessed toxic qualities. ***M. Nishmi and H. Bernkopf.*** *Journal of Immunology*, v. 81, no. 6, Dec. 1958, p. 460-466.

3746* The Metabolism of Some Antigen-Antibody Complexes in the Rabbit. Rabbits sensitized to beef gamma globulin (BGG) and normal controls were injected intravenously with small amounts of insoluble, suspended complexes formed *in vitro* between I^{131}-trace labeled BGG (I^{131}-BGG) and its homologous rabbit antibody. At intervals animals were sacrificed and the protein bound activity was determined in their blood and organs. It has been shown that the clearance from the blood proceeds more rapidly in sensitized than in control animals because the antibody in their serum reduces dissociation of complex. The organ distribution pattern is similar in both sensitized rabbits and controls and it thus appears that elimination of complex from blood does not depend on any sensitization of

tissues. The spleen, shortly after injection, has the highest specific activity of any organ. Thermally denatured I^{131}-BGG, when injected intravenously, is eliminated from blood at rates comparable to antigen-antibody complex in sensitized rabbits, but is excreted more rapidly from the organism. A difference in the rate of degradation and elimination of native insoluble protein (antigen-antibody complex) and denatured insoluble protein is indicated. ***Harry Walter and Herbert Zipper.*** *Journal of Immunology*, v. 82, no. 1, Jan. 1959, p. 12-18.

3747 Metals and Enzyme Activity. Presents synopses of papers from a biochemical symposium held at the University of Leeds in July, 1956. Symposium topics included enzyme-metal-substrate complexes, metal-peptide complexes in aqueous solution, univalent metals, and other loose or non-specific activations, the role of metals in certain catalyzed oxidations and catalytically active hemoproteins. ***E. M. Crook, editor.*** 102 pp. 1958. Cambridge University Press, London. (QD411 C88m)

3748 Microbial Ecology. Various papers forming the basis of a symposium on microbial ecology held in London in April 1957 and dealing with the genetic basis of microbial variation, the interaction of microbes with their inanimate environment, the interactions between microbes, and the ecology of various groups of microbes, in several cases with special reference to their interaction with higher organisms. 388 pp. 1957. Cambridge University Press, London. (QR6 So13m)

3749* The Use of the Cryostat in Histology and Histochemistry. With the cryostat it is possible to produce slides of fresh tissue quickly which show no artifacts, either by shrivelling or by formation of ice crystals. (*In German.*) Über die Brauchbarkeit des Kryostaten in Histologie und Histochemie. ***P. B. Diezel.*** *Mikroskopie*, v. 13, no. 5/6, Nov. 1958, p. 196-201.

3750* Enzymatic Synthesis of Deoxyribonucleic Acid. V. Chemical Composition of Enzymatically Synthesized Deoxyribonucleic Acid. The purine and pyrimidine composition of DNA, enzymatically synthesized in the presence of a variety of DNA primers agrees with the composition data for DNA samples isolated from nature and with the requirements of the DNA structure proposed by Watson and Crick. ***I. R. Lehman, et al.*** *National Academy of Sciences, Proceedings*, v. 44, Dec. 1958, p. 1191-1196.

3751* The Somatic Chromosomes of Man. Counts were performed on almost 2,000 cells, of which 99.9% revealed chromosome numbers of 46 or 92, the tetraploid frequency being less than 3%. ***J. H. Tjio and T. T. Puck.*** *National Academy of Sciences, Proceedings*, v. 44, Dec. 1958, p. 1229-1237.

3752* Dependence of Mutation Frequency on Radiation Dose Rate in Female Mice. The specific locus mutation rate in females is significantly higher following acute than following chronic irradiation. Concludes that there is a dose-rate effect on the mutation process itself. ***W. L. Russell, Liane Brauch Russell, and Mary B. Cupp.*** *National Academy of Sciences, Proceedings*, v. 45, Jan. 1959, p. 18-23.

3753* On the Nature of the Aging Process. Describes a hypothetical biological process that could conceivably account for the phenomenon of aging. The theory assumes that the elementary step in the process of aging is an "aging hit", which "destroys" a chromosome of the somatic cell, in the sense that it renders all genes carried by that chromosome inactive. The "hit" need not destroy the chromosome in a physical sense. The theory postulates that when the surviving fraction of the somatic cells of an individual, approaches a certain critical value, then the probability that that individual may die within a period of one year will come close to 1. On this basis, the theory establishes a relationship between the surviving fraction of the somatic cells and the age of death of the individual. ***Leo Szilard.*** *National Academy of Sciences, Proceedings*, v. 45, Jan. 1959, p. 30-45.

3754* The Effects of Strontium-90 on Mice. A new analysis of the data previously reported for mice by Dr. Miriam P. Finkel. The present authors dispute her conclusion from these data that it is extremely unlikely that the Sr-90 from the fallout from nuclear weapons tests will induce even one bone tumor or one case of leukemia in human beings as being completely unjustified. ***Barclay Kamb and Linus Pauling.*** *National Academy of Sciences, Proceedings*, v. 45, Jan. 1959, p. 54-69.

3755* Symposium on New Developments in the Study of Color Vision. Five papers on theory, threshold sensitivity, visual pigments, and causes of color blindness. *National Academy of Sciences, Proceedings*, v. 45, Jan. 1959, p. 89-129 + 2 plates.

3756 Alleged Susceptibility of Sulphydryl Enzymes to Ionizing Radiation. Sulfhydryl enzymes, muscle glyceraldehyde-3-phosphate dehydrogenase and yeast alcohol dehydrogenase, are inactivated by X-rays with about the same ionic yield as various non-sulfhydryl enzymes. ***A. Pihl, R. Lange, and L. Eldjarn.*** *Nature*, v. 182, Dec. 20, 1958, p. 1732-1733.

3757 Local Reaction to Non-Metastasizing and Metastasizing Transplantable Tumours. A mast-cell barrier around the grafts of Walker adenocarcinoma and rat sarcoma which do not metastasize and grow extensively may indicate a defense against infiltration. Around metastasizing tumors, the tissue reaction is represented by a loose connective tissue which is easily invaded by tumor cells and which, being rich in vascular formations, facilitates their passage into the circulation and consequently the onset of metastases. The ability to induce metastases may not be directly dependent upon intrinsic characters of the cell but rather upon the reaction induced and established by the tumor cell in the host tissue. ***C. Maltoni.*** *Nature*, v. 182, Dec. 20, 1958, p. 1742.

3758 Bacteriophage Research. A synopsis of discussions held at the Second International Phage Colloquium in August 1958. Topics included: anatomy of the phage particle; metabolism of infected bacteria; synthesis of phage constituents; kinetics of recombination; the elementary recombination act; genetic fine structure; replication; prophage and chromosome, transduction; phage conversion; and bacteriocines. ***Gunther S. Stent.*** *Nature*, v. 182, Dec. 27, 1958, p. 1769-1770.

3759* Possible Causes of the Differential Radiation Sensitivity of Genetic Material in Cell Nuclei of Different Ages. Concludes that the differences in sensitivity of genetic materials is controlled at least partially by differences in intracellular oxygen content. (*In German.*) Mögliche Ursachen der verschiedenen Strahlenempfindlichkeit des Erbmaterials in Keimzellen unterschiedlichen Alters. ***Hedi Fritz-Niggli.*** *Naturwissenschaften*, v. 45, no. 23, Dec. 1958, p. 557-564.

3760* A Swallowable Intestinal Transmitter for Indicating pH-Values. (*In German.*) Über den verschluckbaren Intestinalsender für pH-Wert-Signalisierung. ***M. von Ardenne and H. B. Sprung.*** *Naturwissenschaften*, v. 45, no. 23, Dec. 1958, p. 564-565.

3761* Introduction of Bromine Into Nucleic Acid. (*In German.*) Einführung von Brom in Nucleinsäuren. ***Walter Kanngiesser.*** *Naturwissenschaften*, v. 45, no. 23, Dec. 1958, p. 568.

3762* Cytochrome Oxidase and Resistance to Isonicotinic Acid Hydrazide of Mycobacteria. (*In French.*) Cytochromeoxydase et Résistance à l'Hydrazide de l'Acide Isonicotinique (INH) des Mycobactéries (Souches B.C.G.). ***Eugenia Soru, Maria Istrati, and Maria Paraschivesco.*** *Naturwissenschaften*, v. 45, no. 23, Dec. 1958, p. 578.

3763* Some DNA-Dependent Synthetic Systems of Isolated Cell Nuclei. In nuclei which have been isolated, it is possible to remove as much as 75% of their deoxyribonucleic acid content by treatment with deoxyribonuclease. Nuclei so depleted of their DNA lose most of their capacity for synthesizing ATP, protein, and RNA. The addition of polyanions restores function. The polyanions tested include DNAs, RNAs, polyadenylic acid, and such nonnucleotides as polyethylene sulfonate, heparin, and chondroitin sulfate. ***V. Allfrey and A. E. Mirsky.*** *New York Academy of Sciences, Transactions*, v. 21, no. 1, Nov. 1958, p. 3-16.

3764* Electron Spin Resonance Studies of Radiation Damage to Proteins. Proteins investigated give either a doublet resonance characteristic of glycylglycine, a field-dependent resonance characteristic of cystine, or a combination of the two.

Walter Gordy and Howard Shields. *Radiation Research*, v. 9, no. 6, Dec. 1958, p. 611-625.

3765* The Effect of Dose Rate on Genetic Damage From Fast Electrons in *Drosophila* Sperm. No significant differences due to dose rate can be found in the amount of effect produced, although the highest rates used were markedly higher than those employed in the two studies in which an effect was demonstrated. ***Armon F. Yanders.*** *Radiation Research*, v. 10, no. 1, Jan. 1959, p. 30-36.

3766* The Nature of the Effect of ACTH and Cortisone on Tumor Growth in Irradiated Animals. The administration of ACTH or of cortisone in association with irradiation for at least 14 days after transplantation of 2 mammary carcinomas and one neuroblastoma into the anterior chamber of the eye in young mice of susceptible strains, resulted in an increase in the seventy-day-survival rate in both strains of mice with all 3 tumors used. ***Henry P. Plenk, Roger Fuson, and Fred M. Sorensen.*** *Radiology*, v. 72, no. 1, Jan. 1959, p. 75-80.

3767* Experiments on Aeration Methods During Mycological Citric Acid Fermentation. Aeration of the fermenting medium with the aid of a special vibro-mixer reduced the time of fermentation and achieved a high rate of conversion. ***Z. Berk and J. B. S. Braverman.*** *Research Council of Israel, Bulletin*, v. 6C, no. 2, Feb. 1958, p. 143-152.

3768* Porphyrin Biosynthesis. A study of the iron complexes of porphyrins, or hemes; of the biosynthesis of the heme of hemoglobin; historical review and critical discussion; porphobilinogen formed in tissue systems from glycine; relation of uro-, copro- and proto-porphyrins to heme synthesis. Incorporation of iron to form heme. Various types of porphyria. ***C. Rimington.*** *Reviews of Pure and Applied Chemistry*, v. 8, no. 3, Sept. 1958, p. 129-160.

3769* The Cytochromes. A study of the cytochromes now available as highly purified proteins. General characteristics of cytochromes of groups A, A-2, B, C, and D. Comparison of absorption spectra of cytochromes of group A, and of complexes of heme *a* and of *Spirographis* heme. Structure and reactivity. Amino acid composition. ***R. K. Morton.*** *Reviews of Pure and Applied Chemistry*, v. 8, no. 3, Sept. 1958, p. 161-220.

3770* Hormonal Synergism in Mammary Growth. A comprehensive review. ***W. R. Lyons.*** *Royal Society, Proceedings*, v. 149, ser. B, Dec. 17, 1958, p. 303-325 + 2 plates.

3771* The Action of γ-Rays on Sodium Deoxyribonucleate in Solution. ***R. A. Cox, W. G. Overend, A. R. Peacocke, and S. Wilson.*** *Royal Society, Proceedings*, v. 149, ser. B, Dec. 24, 1958, p. 511-533.

3772* Neonatal Immunity. II. Poliocidal Effects of Human Amniotic Fluids. . . . is associated with the γ globulin and is active against all 3 serotypes of viruses. The level of antibody in general was demonstrable in the amniotic fluid when the serum level was high. ***Alex J. Steigman and Murray M. Lipton.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 576-579.

3773* Protective Effect of Seaweed Extracts for Chicken Embryos Infected With Influenza B or Mumps Virus. . . . is shown even when treatment is delayed 24 hours. Extracts had no effect on the multiplication of influenza A virus and Newcastle disease virus. ***Paul Gerber, James D. Dutcher, Eugene V. Adams, and John H. Sherman.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 590-593.

3774* Immunologic Tolerance in Rats to Type Specific Antigens of Human Erythrocytes. Intraperitoneal injection of human erythrocytes in pre-natal or neo-natal rats reduces antibody response to subsequent immunizations with no-ill effects in survivors of the initial injection and no difference in growth rate from uninjected controls. ***Paul Calabresi and Earl A. Edwards.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 602-604.

3775* Factors Influencing Isoimmunization in Rabbit. Effect of Early Postnatal Immunization on Specific Isoantibody Response. In a first systematic testing of the hypothesis of Mitchison, Brambell, and Owen that inhibition of antibody production may result from exposure of the fetus or newborn to incompatible homologous blood, it was shown that introducing incompatible whole blood into newborn rabbits can alter response of these animals to a later encounter with the same isoantigen. An initial 15 injections given from the day of birth decreased isoantibody production significantly, but not completely. Further injections effected complete inhibition of specific isoantibody production. ***Carl Cohen.*** *Society of Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 607-610.

3776* Concentrative Uptake of 6-Diazo-5-Oxo-L-Norleucine by Sarcoma 180, Liver and Muscle *in vivo*. DON is concentrated intracellularly in S 180 and liver to levels 5-fold and 4-fold higher respectively than the extracellular concentration at a plasma level of 0.8-0.9 mM/kilo of plasma water. Intracellular concentrations in skeletal muscle were the same or less than the extracellular. ***John A. Jacquez.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 611-613.

3777* Alteration of Homograft Reaction by A-methopterin in Lethally Irradiated Mice Treated With Homologous Marrow. Mice survived a homograft reaction following lethal, totalbody X irradiaton and homologous marrow inoculation, when treated with folic acid antagonist, A-methopterin. Varying degrees of effectiveness were obtained. ***Delta E. Uphoff.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 651-653.

3778* Genetic Differences in Hemoglobin as Markers for Bone Marrow Transplantation in Mice. The hemoglobin type and the red cell serotype seem to be under the autonomous control of the genotype of the nucleated cell from which the erythrocyte is derived. Hemoglobin typing may be particularly useful where the H-2 markers cannot be used. ***Raymond A. Popp, G. E. Cosgrove, Jr., and R. D. Owen.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 692-694.

3779* Failure of Deoxyribonucleic Acid to Effect Somatic Transformation in the Rat. DNA derived from black and white rats, on injection into newborn albino rats, failed to produce pigmentary changes in the hair and the eyes. Similarly, DNA derived from normal rats failed to correct a genetically determined absence of glucuronyl transferase in newborn jaundiced rats. ***Thomas L. Perry and Dorothy Walker.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 99, no. 3, Dec. 1958, p. 717-720.

3780* Immunologic Treatment of Tumors. Antibodies were produced by injecting cancer cells obtained from Walker 256 tumor into rabbits; injection of the globulin fraction prevented "takes" of Walker 256 cells in slightly over half of rats inoculated with 10,000 cells. The globulin antibody solution produced a decrease in size by about one quarter when given to rats with tumors 2 to 3 cm. in diameter, but the tumor masses did not disappear. The method was tried in 2 patients with decrease in size of the tumor but not disappearance. ***John A. McCredie, Eric R. Brown, and Warren H. Cole.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 100, no. 1, Jan. 1959, p. 31-33.

3781* Successful Skin Homografts in Mature Non-Littermate Rats Treated With Fractions Containing Alpha-Globulins. Demonstrates that tolerance to skin homografts can be induced in immunologically mature albino rats by use of serum fractions containing alpha-globulins. ***Benjamin B. Kamrin.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 100, no. 1, Jan. 1959, p. 58-61.

3782* Propagation of Mouse Hepatitis Virus (Gledhill) in Tissue Culture. The Gledhill strain of mouse hepatitis virus (MHV 1) was passaged through 10 successive tissue cultures of newborn mouse kidney explants. As MHV 1 did not cause reproducible cytopathogenic effects, infectivity tests with newborn mice were used to detect propagation of this virus in serially passaged cultures. Observations suggest that virus was adsorbed by the proliferating explants and that cell-free culture fluids were infective. Total time of virus growth far exceeded decay rate of the virus incubated without tissue. After the tenth

passage, the virus had been diluted 10^{12}-fold which exceeded the extinction point of the original inoculum. ***Theodore J. Starr and Morris Pollard.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 100, no. 1, Jan. 1959, p. 97-100.

3783* Urinary Excretion of Beta Aminoisobutyric Acid (BAIBA) in Irradiated Human Beings. Beta-aminoisobutyric acid (BAIBA) has been found in increased amounts in urine from a group of human beings accidentally exposed to serious radiation. BAIBA levels excreted appear related to the estimated doses received. The implications of BAIBA excretion as related to DNA metabolism and irradiation-induced aplasia are discussed. ***J. R. Rubini, E. P. Cronkite, V. P. Bond, and T. M. Fliedner.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 100, no. 1, Jan. 1959, p. 130-133.

3784 Reviews on Radiobiology. Biochemical fundamentals of the biological action of ionizing radiations; action of ionizing radiations on mammals; the nervous system and ionizing radiations; and morphological changes of the nucleus and chromosomes under the influence of various kinds of radiation. ***A. M. Kuzin, editor.*** *U. S. Atomic Energy Commission, AEC-tr-*3353, 1956, 403 pp. (Translated from a publication of the Institute of Biological Physics, Academy of Sciences, U.S.S.R., Moscow, 1956.) (UF767 Un3.1ae Contin.)

3785* Cultivation of Human Breast Carcinomas. This technique, taking advantage of the weak intercellular bonds within the tumor, harvests the cells "spilling" out of the tumor stroma when thin slices are cut with a razor blade. Continuous cultivation of human breast carcinoma cells was achieved for the first time. ***Etienne Y. Laseargues and Luciano Ozzello.*** *U. S. National Cancer Institute, Journal*, v. 21, no. 6, Dec. 1958, p. 1131-1140 + 3 plates.

3786* The Radiochemical Synthesis of Amino Acids and Similar Compounds. A study of the mode of formation of methylamine from methane and ammonia, of amino acids from the ammonium salts of the homologous aliphatic carbonic acids, of amino acids from amines by means of the combination of two simpler types of molecules. (*In German.*) Die radiationschemische Synthese von Aminosäuren und verwandten Verbindungen. ***Klaus Dose and Kitty Ettre.*** *Zeitschrift für Naturforschung*, v. 13b, Dec. 1958, p. 784-788.

See also: **3703** (physiology and biochemistry of lactation); **3965** (psychopharmacological activity of substituted β-phenethylamines); **4754** (biochemistry of sewage treatment).

CERAMICS AND CONCRETE

3787* Lightweight Concrete Deck for Tappan Zee Bridge Main Spans. This project demonstrates that high strength lightweight concrete may be produced using cement factors similar to those required for normal weight concrete through the use of drier consistencies with lowered total water content. ***W. G. Mullen.*** *American Concrete Institute, Journal*, v. 30, no. 6, pt. 1, Dec. 1958; *ACI Proceedings*, v. 55, 1958, p. 685-694.

3788 How to Tool for Making Pressed Ceramic Parts. II. Tips on design of punches and dies. Minor changes in design of parts which will make production more economical and take full advantage of the compacting process. ***Sam Bradbury.*** *Ceramic Industry*, v. 72, Jan. 1959, p. 72 + 2 pages.

3789* Thermal Effects on Some Kaolin Minerals. I. Kaolinite and Kibushi-Clay. Fundamental information regarding the change in the structure of kaolinite with heat-treatment in the relatively low temperature region are presented, through X-ray diffraction method, differential thermal analysis, and particularly using these in conjunction with density measurement. ***Hiroshi Takahashi.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 9, Dec. 1958, p. 1031-1035.

3790 The Temperature-Dependence of the Elastic Moduli of Vitreous Silica. The modulus of vitreous silica increases with increasing temperature above 60 K. This anomalous behavior is investigated theoretically, and it is shown to be already implied by the very low coefficient of thermal expansion. ***G. J. Dienes.*** *Physics and Chemistry of Solids*, v. 7, no. 4, Dec. 1958, p. 290-294.

3791* Causes and Control of Volume Change. An elementary discussion of shrinkage and swelling of hardened cement paste produced by changes of moisture content is followed by consideration of internal restraints and other factors controlling the amount of shrinkage and swelling of concrete. It is shown that the most unfavorable combinations of factors influencing volume change might result in perhaps seven times as much shrinkage as would result from the most favorable combinations. ***Treval C. Powers.*** *Portland Cement Association, Journal of the Research and Development Laboratories*, v. 1, no. 1, Jan. 1959, p. 29-39.

3792 Development of Cement Performance Tests and Requirements. Historical review of early investigations in U. S. and abroad. Present ASTM specifications. ***H. F. Gonnerman.*** *Portland Cement Association, Research Department Bulletin* 93, Mar. 1958, 35 pp. (TP883 P83b Vis.)

3793* Validity of the Test Used in Checking the Degree of Clinkering in the Rotary Kiln by Determining the Weight of a Liter of Clinker (PL-Test). (*In French.*) La validité du test de contrôle de la clinkérisation au four rotatif par la mesure du poids du litre du clinker (PL-test). ***Michel J. M. Jaspers.*** *Revue des Matériaux de Construction (Edition C)*, 1958, no. 518, Nov., p. 283-291.

3794* Some Results From Laboratory Tests of Fly Ash and of Cements Incorporated With Ash of the Same Origin. (Insoluble Matters - Firing at 1000°C - Pozzalanic Capacity). (*In French.*) Quelques résultats d'expériences de laboratoire sur les cendres volantes et les ciments aux cendres. (Insolubles - Cuisson à 1,000° - Pouvoir pouzzolanique). ***A. Jarrige and R. Ducreux.*** *Revue des Materiaux de Construction (Edition C)*, 1958, no. 518, Nov., p. 300-305.

3795* The Grindability of Clinkers and Its Application to Commercial Grinders. Study of grinding and agglomerating capacities based on the concept of average grinding volume. The higher the tricalcium silicate content, the greater is the grindability of the clinkers. (*In French.*) La broyabilité des clinkers et son application aux broyeurs industriels. ***M. Papadakis.*** *Revue des Matériaux de Construction (Edition C)*, 1958, no. 519, Dec., p. 321-338.

3796 The Markings on Fracture Surfaces. Fracture surfaces on glasses exhibit characteristic marking which can be interpreted in terms of the author's theory of propagation of fracture; this theory is summarized briefly and is illustrated by a collection of photographs of various forms of fracture surfaces. ***Eugene F. Poncelet.*** *Society of Glass Technology, Journal*, v. 42, Dec. 1958, p. 279T-288T + 8 plates.

3797* New Data on Fine Grinding. Capacity of ball mills can be greatly increased by grinding at speeds greater than critical. (*In Russian.*) Novyye zakonomernosti tonkogo izmel'cheniya. ***R. T. Khukki.*** *Tsvetnyye Metally*, v. 32, no. 10, Oct. 1958, p. 3-16.

3798 Thermal Expansion of Al_2O_3, BeO, MgO, B_4C, SiC, and TiC Above 1000°C. Data were obtained to the temperatures where permanent deformation set in, due to sintering or other causes. The thermal expansion for these materials was found to be approximately linear over the measured temperature range. ***Charles J. Engberg and Ernest H. Zehms.*** *U. S. Atomic Energy Commission, NAA-SR-*3086, Nov. 30, 1958, 25 pp. (UF767 Un3.1na Contin.)

See also: **4370** (designing with brittle materials); **4556** (cermet powder metallurgy).

CHEMICAL ENGINEERING

3799 Liquid-Phase Adsorption Equilibria. A correlating equation for liquid-phase adsorption equilibria, including the effects of temperature and pore diameter, is presented, with a

derivation of the equation ascribing the equilibration process of physical adsorption to van der Waal's forces. ***Edward B. Stuart and James Coull.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 383-388.

3800 A General Index of Fractional Distillation Power for Hydrocarbon Mixtures. A quantitative criterion for sharpness of fractionation with complex mixtures, the Fractionation Index, is suggested. ***R. L. Geddes.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 389-392.

3801 Perforated Plate Efficiency-Effect of Design and Operating Variables. Experimental plate efficiency and pressure drop data were obtained on the *n*-octane-toluene system in a 5 plate, 6 in. diam. column at atmospheric pressure. The effect of changing inner parameters was studied. Reflux ratios of one, two, four, five, ten, and total were utilized to determine the effect on efficiency. It was found that hole diameter, free area, plate spacing, and a wide range of reflux ratio had relatively small effect on efficiency and pressure drop; however, weir height and lower reflux showed relatively larger effects on both variables. ***J. D. Hellums, C. J. Braulick, C. D. Lyda, and Mathew van Winkle.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 465-471.

3802 A Theoretical-Empirical Approach to the Mechanism of Particle Entrainment From Fluidized Beds. A means of calculating the rate of entrainment of solids from commercial-size continuously operating fluidized beds was developed from the combined results of a theoretical and an empirical approach. ***F. A. Zenz and N. A. Weil.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 472-479.

3803* Maintenance of Centrifugal Pumps. III. Care of shafts, shaft sleeves, bearings and the reassembly of pump rotors. ***Igor J. Karassik and Roy Carter.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Jan. 1959, p. 92-96.

3804* Ways of Formation of Propylene and Ethylene in the Cracking of Isobutylene. Study by the isotope kinetic method shows that propylene is formed both from isobutylene and from intermediate products. Only a portion of ethylene is formed from propylene, the rest either directly from isobutylene or from liquids. (*In Russian.*) Puti obrazovaniia propilena i etilena pri krekinge izobutilena. ***V. D. Moiseev, et al.*** Akademiia *Nauk SSSR, Doklady*, v. 123, no. 2, Nov. 11, 1958, p. 292-294.

3805 Properties of Water. V. Pressure-Volume-Temperature Relations of Water in the Range 400-1000 C and 100-1400 Bars. New measurements of specific volume of water along 11 isotherms in the range of 400 to 900 C were examined. ***William T. Holser and George C. Kennedy.*** *American Journal of Science*, v. 257, no. 1, Jan. 1959, p. 71-77.

3806* Effect of Impoundment on Downstream Water Quality. Seasonal variations in water quality of the Catawba River from 1954 to 1957, effect of reservation of the Holston River, DO concentration during power wave of a power impoundment. Short term changes. Two damaging factors below the point of pollution from the high flow of the power wave. ***Robert S. Ingols.*** *American Water Works Association, Journal*, v. 51, Jan. 1959, p. 42-46.

3807* Nature and Effects of Filter Backwashing. Study of the rates and methods used in backwashing a filter bed. Jet action in order to expand gravel beds. Gravel grading; heavy gravel, flow through gravel. Application to a filtration plant. ***John R. Baylis.*** *American Water Works Association, Journal*, v. 51, Jan. 1959, p. 126-156.

3808* Agitation-Aeration in Submerged Fermentation. I. A Comparative Study of the Sulfite and Polarographic Methods for Measuring Oxygen Solution Rates in a Fermentor. II. Effect of Solid Disperse Phase on Oxygen Absorption in a Fermentor. ***R. Steel and M. R. Brierley.*** *Applied Microbiology*, v. 7, no. 1, Jan. 1959, p. 51-61.

3809* Studies in Waxes. XIII. Refining Sugar-Cane Wax by Fractionation From Solvents. ***H. H. Hatt and A. H. Redcliffe.*** *Australian Journal of Applied Science*, v. 9, no. 4, Dec. 1958, p. 380-403.

3810* Heat Transfer to Boiling Binary Liquid Mixtures. I. Heat flux values in nucleate boiling can be obtained with binary mixtures boiling in the range from 10-50 atm., exceeding considerably the maximum values attainable with water boiling at an arbitrary pressure on the same heating surface. ***S. J. D. Van Stralen.*** *British Chemical Engineering*, v. 4, Jan. 1959, p. 8-17.

3811 Distribution of Residence Times in Continuous Series of Mixing Zones. It is shown how accurate values for the number fraction distribution of residence times can be obtained for systems comprising up to 75 mixing zones by use of tabulated values of the Poisson Exponential Binominal Limit. The theory is extended to include the effect of recycle. ***E. J. Buckler and L. Breitman.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 25-28.

3812 Equation Suggested for Mixing Powdered Materials. An equation for mixing is submitted and the relationships between its parameters and the physical dimensions of the particles and mixes investigated. *Chemical Age*, v. 80, Dec. 20, 1958, p. 1025.

3813 Chelates Growing Up—Fast. Present production of the tetrasodium salt of EDTA; outlets found in dyeing, water treatment. *Chemical and Engineering News*, v. 37, no. 4, Jan. 26, 1959, p. 36-37.

3814 SX Enters Saline Water Race. Secondary and tertiary amines are best bets as solvents; economics seem promising. *Chemical and Engineering News*, v. 37, no. 5, Feb. 2, 1959, p. 40 + 1 page.

3815* Hydrogen Peroxide. Big New 'Autoxidation' Plant at Warrington. A process developed by Laporte Chemicals Ltd. based on the use of 2-ethyl anthraquinone in solution, using a continuous and cyclic process for which the major raw materials are H, atmospheric O, and water. *Chemical & Process Engineering*, v. 40, Jan. 1959, p. 5-7.

3816* Cutting the Cost of Heavy Water. Some new heavy-water processes, proposed or actually in operation. ***M. C. Reece.*** *Chemical & Process Engineering*, v. 40, Jan. 1959, p. 16-18.

3817 High Purity Aromatics From Coke-Oven Oil. Process flowsheet is presented. ***C. S. Cronan.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 110-113.

3818 Save on Material Cost. Insulation on the inside of equipment rather than outside allows use of less expensive materials of construction. ***R. E. Thompson.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 119-123.

3819 How to Calculate Liquid Viscosity. Engineering calculation methods. ***Wallace R. Gambill.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 127-130.

3820 Design So Solids Can't Settle Out. New equation establishes pipe size and rate of flow when solids and liquid densities and particle size are known. ***J. G. Lowenstein.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 133-135.

3821 Three Versions of Inventa Urea Process Operating. Process flowsheet. ***C. S. Cronan.*** *Chemical Engineering*, v. 66, Jan. 26, 1959, p. 78-81.

3822 Quick Way to Radiant Heat Transfer. Simple charts for getting a radiant heat transfer coefficient. ***Aaron Feder.*** *Chemical Engineering*, v. 66, Jan. 26, 1959, p. 101-104.

3823 Chemical Engineering Practice. v. VI. Fluid Systems. II. ***Herbert W. Cremer and Trefor Davies, editors.*** 600 pp. 1958. Academic Press, New York. (TP155 C42e)

3824 Petrochemicals Production. A compendium of up-to-the-minute ethylene purification technology. Purification, demethanization, acetylene removal, ethylene process. *Chemical Engineering Progress*, v. 54, Dec. 1958, p. 39-59.

3825 Solids Processing. A cross-section of the field of solids processing, including classification, crystallization, and filtration. *Chemical Engineering Progress*, v. 54, Dec. 1958, p. 60-76.

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3827* Production of Aliphatic Acids and Aliphatic Alcohols by Ozone Splitting of Olefins. (*In German.*) Gewinnung von Fettsäuren und Fettalkoholen durch Ozonspaltung von Olefinen. ***Heinrich Bertsch, Anneliese Greiner, and Günter Wagner.*** *Chemische Technik*, v. 10, no. 12, Dec. 1958, p. 690-692.

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See also: **4024** (vapor-liquid equilibrium); **4140** (costs of chemical processing equipment); **4174** (flow of liquid in a cylindrical mixing vessel); **4178** (anomalies in fluid flow); **4216** (cleaning of jet fuels); **4254** (petroleum panorama—oil centennial); **4612** (operators research and the chemical industry).

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3931 Studies on the Chemistry of Halogens and of Polyhalides. XVII. Halogen Complexes of Pentamethylenetetrazole. Electron donor properties of a convulsant agent, pentamethylenetetrazole (PMT), were investigated by studying its complexes with iodine and iodine halides. ***Alexander I. Popov, Carla Castellani Bisi, and Marilyn Craft.*** *American Chemical Society, Journal*, v. 80, Dec. 20, 1958, p. 6513-6516.

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3936 Azo Compounds. An Eight-Membered Cyclic Azo Compound. 3,8-Diphenyl-1,2-diaza-1-cyclooctene was prepared and characterized. ***C. G. Overberger and I. Tashlick.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 217-221.

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3946* Compounds Containing Carbon-Phosphorus Bonds. ***P. C. Crofts.*** *Chemical Society, Quarterly Reviews*, v. 12, no. 4, 1958, p. 341-366.

3947* Beckmann Rearrangement in Liquid Sulfur Dioxide. IV. Syntheses of 1-Methyl-3,4-dihydro-isoquinoline and 9-Phenyl-phenanthridine. ***Ritsuro Tada, Hisanori Sakuraba, and Niichiro Tokura.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 9, Dec. 1958, p. 1003-1007.

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3949* Benzylation of Allylbenzene. Formation of 3,4-Diphenyl-1-butene and 3-Benzyl-3,4-diphenyl-1-butene. Structures of the products formed in the reaction and relations between the products. ***Teisuke Ando and Niichiro Tokura.*** *Chemical Society of Japan, Bulletin*, v. 31, no. 9, Dec. 1958, p. 1026-1030.

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3952 Dienophilic Properties of the Esters of Some Enolacetates and Enolethers of α-Acetonic Acids. The Diels-Alder reaction technique was applied to the study of the behavior of the esters of α-ethenic α-acetoxy and α-alcoxy acids in the presence of dimethyl 2,3-butadiene and in some cases of diphenyl 1-4-butadiene. (*In German.*) Propriétés philodiéniques d'esters de quelques énolacétates et énoléthers d'acides α-cétoniques. ***Jacques Monnin.*** *Helvetica Chimica Acta*, v. 41, no. 7, 1958, p. 2112-2120.

3953 Fluorescent Substances From *Drosophila melanogaster*. XI. Chemical Properties of 2-Amino-6-hydroxy Pteridine. The pteridine was acetylated into 2-acetylamino-6-hydroxy-pteridine and was hydrated into 2-amino-6-hydroxy-7,8,9,10-tetrahydropteridine. The acetylpteridine can form either a 7,10-dihydro- or a 7,8,9,10-tetrahydro-acetyl derivative. (*In German.*) Fluoreszierende Stoffe aus *Drosophila melanogaster*. XI. Chemische Eigenschaften des 2-Amino-6-hydroxy-pteridins. ***M. Viscontini and H. R. Weilenmann.*** *Helvetica Chimica Acta*, v. 41, no. 7, 1958, p. 2170-2177.

3954* Studies on the Production of Terephthalic Acid. III. Liquid Phase Air Oxidation of *p*-Cymene and Diisopropylbenzenes. The liquid phase oxygen-oxidation of *p*-cymene, and of diisopropylbenzenes, was studied at temperatures of 135-170 C under atmospheric pressure. (*In Japanese.*)

Nobuto Ohta. *Government Chemical Industrial Research Institute, Tokyo, Reports*, v. 53, Oct. 1958, p. 343-350.

3955* Studies in the Formation of Heterocyclic Rings Containing Nitrogen. VI. Condensation of 4-Chloro-*o*-phenylenediamine With Aromatic Aldehydes. ***N. V. Subba Rao and C. V. Ratnam.*** *Indian Academy of Sciences, Proceedings*, v. 48, sec. A, no. 5, Nov. 1958, p. 256-262.

3956* Steroids. XXVII. The Reaction of 6β-Chlorocholestane-3β,5α-diol Diacetate With Silver Acetate. 1. Stereospecific Synthesis of Cholestane-3β,5α,6α-triol. ***Susumu Mori and Mutsuko Yoshida.*** *Japan Academy, Proceedings*, v. 34, no. 9, Nov. 1958, p. 612-615.

3957 Synthesis of Some New Triarylethylene Glycols and Attempts to Oxidize These to α-Arylbenzoins. In an attempt to develop a general synthetic route to α-arylbenzoins several 1,1-diphenyl-2-arylethylene glycols have been prepared and oxidized with various reagents. ***Jerome F. Eastham and Donald J. Feeney.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1826-1829.

3958 A New Method for Introducing a Two Carbon Acid Side Chain Into Ketones. Alkali-catalyzed condensation of glyoxylic acid, or esters thereof, with α-tetralone (and other α-tetralones) to yield 1-keto-1,2,3,4-tetrahydro-2-naphthylideneacetic acid (and similar acids) is described. ***Melvin S. Newman, William C. Sagar, and C. C. Cochrane.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1832-1835.

3959 Reactions of Magnesium Hydride and Diethylmagnesium With Olefins. Magnesium hydride was found to add to ethylene, 1-octene, and isobutylene to form the Mg-C bond in low yields. Diethylmagnesium was found to be considerably more reactive than magnesium hydride toward olefins. ***H. E. Podall and W. E. Foster.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1848-1852.

3960 Reaction of Methyl Isopropenyl Ketone With Formaldehyde. Formaldehyde and methyl isopropenyl ketone in the presence of base were found to react with participation of the solvent methanol to give 3-methoxymethyl-2-butanone and 3-hydroxymethyl-3-methoxymethyl-2-butanone. ***Charles H. Tieman and Marvin H. Gold.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1856-1858.

3961 Preparation and Properties of Styrenyl-Substituted Organosilicon Compounds. Preparation and physical properties of five *p*-styrenyl-substituted silane monomers and one disiloxane. ***Daniel W. Lewis.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1893-1895.

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3963 Potential Anticancer Agents. XII. The Reaction of Chloroacetonitrile With L-Cysteine, DL-Homocysteine, and Cysteamine. XV. Synthesis of 9-β-D-Glucofuranosyladenine. XII. ***Leon Goodman, L. O. Ross, and B. R. Baker.*** XV. ***Elmer J. Reist, Roland R. Spencer, and B. R. Baker.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1954-1962.

3964 Synthesis of *O*- and *N*-Methylated Derivatives of 5-Hydroxytryptamine. Several new methylated derivatives of serotonin and bufotenine having potential physiological interest were prepared. Convenient syntheses of 1-methylbufotenine, 5-methoxy-*N*,*N*-dimethyltryptamine, and 1-methyl-5-methoxy-*N*,*N*-dimethyltryptamine from 5-benzyloxyindole are described. ***F. Benington, R. D. Morin, and Leland C. Clark, Jr.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1977-1979.

3965 Psychopharmacological Activity of Ring- and Side Chain-Substituted β-Phenethylamines. Synthesis of a number of ring-substituted β-phenethylamines containing alkyl, halogen, and alkoxy substituents by various methods is described. The influence of these ring substituents on the psychotomimetic activity of substituted β-phenethylamines was examined by observing the effect of these compounds on cat behavior. ***F. Benington, R. D. Morin, Leland C. Clark, Jr., and R. Phyllis Fox.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1979-1984.

3966 Action of Grignard Reagents. XII. Action of Organomagnesium Compounds on 5-Aralkylidene Derivatives of Rhodanine and of 3-Phenyl-2,4-thiazolidine. ***Ahmed Mustafa, Wafia Asker, Ahmed Fathy Abdel-Mawgoud Shalaby, and Mohamed Ezz El-Din Sobhy.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 1992-1995.

3967 Mescaline Analogs. IX. Tetra- and Pentamethyl-β-phenethylamines. Ring-substituted tetra- and pentamethyl-β-phenethylamines were all prepared by the same synthesis scheme as outlined by the following general equation, where Ar represents the appropriately polymethyl-substituted phenyl group: $ArH \rightarrow ArCH_2Cl \rightarrow ArCH_2CN \rightarrow ArCH_2CH_2NH_2$. This synthetic route was well suited to this series of compounds, since all of the starting tetra- and pentamethylbenzenes are commercially available or are readily accessible, and the chloromethylation reaction can give only one monochloromethyl product in each case. ***F. Benington, R. D. Morin, and Leland C. Clark, Jr.*** *Journal of Organic Chemistry*, v. 23, Dec. 1958, p. 2034-2035.

3968 Chemistry of Pyrimidines. I. The Reaction of Bromine With Uracils. 5-Bromo-6-hydroxyhydro derivatives are formed by the reaction in aqueous solution. ***Shih Yi Wang.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 11-13.

3969 A New Barbituric Acid Synthesis in Liquid Ammonia-Alkali Hydroxide. II. Condensation of Malonamide Derivatives With Ethyl Carbonate. ***Kotaro Shimo and Shigeru Wakamatsu.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 19-21.

3970 Synthesis of Pyromellitonitrile and Related Compounds. Pyromellitonitrile was prepared by the dehydration of pyromellitamide with thionyl chloride in dimethylformamide. The tetramide could not be dehydrated to the tetranitrile with acetic anhydride, phosphorus oxychloride, phosphorus pentachloride, or benzenesulfonyl chloride. By-products of the thionyl chloride dehydration were 4,5-dicyanophthalimide, and 2,4,5-tricyanobenzamide. 2,5-Dibromoterephthalic acid reacted quantitatively with cuprous cyanide to form pyromellitimide, but dimethyl 2,5-dibromoterephthalate reacted under the same conditions to form dimethyl 2,5-dicyanoterephthalate. Tetrakis(*N*-ethyl)pyromellitamide reacted with phosphorus pentachloride to form *N*,*N*′-diethylpyromellitimide. ***Emil A. Lawton and Donna D. McRitchie.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 26-28.

3971 Substituted γ-Lactones. I. Preparation of α-Substituted γ-Butyrolactones by Condensation of γ-Butyrolactone With Aldehydes. Hydrogenation of the Condensation Products. II. Some Electrophilic Substitution Reactions of α-Benzylidene-γ-butyrolactone. ***Hans Zimmer and Johannes Rothe.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 28-32; 100-103.

3972 Preparation and Some Reactions of Phenoxazine and Phenoselenazine. ***Paulette Müller, N. P. Buu-Hoï, and R. Rips.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 37-39.

3973 Orientation in Friedel-Crafts Acylations of 3-Chloro-2-Methoxybiphenyl. Friedel-Crafts acetylation of 3-chloro-2-methoxybiphenyl is shown to occur in position 5 when the catalyst is stannic chloride, and in both positions 5 and 4′ when aluminum chloride is used. ***N. P. Buu-Hoï and Louis Petit.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 39-41.

3974 Oxidation of Phenols by Periodate. Extent of the reaction is determined by the orientation of the hydroxyl groups in the ring. ***Joseph P. Feifer, Manning A. Smith, and Bennett R. Willeford, Jr.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 90-93.

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3976 Organic Syntheses With Isotopes. I. Compounds of Isotopic Carbon. II. Organic Compounds Labeled With Isotopes of the Halogens, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulfur. ***Arthur Murray, III, and D. Lloyd Williams.*** 1146 pp; 949 pp. 1958. Interscience Publishers, Inc., New York. (QD271 M96o)

3977* On the Compounds of Catechol With Boric Acid. Method of preparing potassium, ammonium, and pyridine salts of dicatechoboric acid by hydrolysis of tricatechol diborate with the corresponding bases. (*In Polish.*) O połączeniach pirokatechiny z kwasem borowym. ***Jiři Procházka and Viktor Ettel.*** *Przemysł Chemiczny*, v. 37, no 11, Nov. 1958, p. 720-721.

3978* On the Study of the Synthesis and the Properties of Naphthylene-bis-Glycolic Acids. Diethyl esters of 1,4-, 1,5-, 1,6-, 1,7-, and 2,7-naphthylene-bis-glycolic acids were prepared (in acetone medium, in the presence of dehydrated potassium carbonate and iodide) by the reaction of ethyl-bromoacetate with the corresponding dihydroxynaphthalenes. (*In Polish.*) Z badań nad synteza i własonościami kwasów naftyleno-bis-glikolowych. ***Marian Janczewski, Bożena Dabrowska, and Bożena Florkiewicz.*** *Przemysł Chemiczny*, v. 37, no. 12, Dec. 1958, p. 784-789.

3979* Chemical Studies on Insecticides. VI. The Rate of Hydrolysis of Some Phosphorus Acid Esters. VII. Dipole Moments of Some Esters of Phosphoric and Phosphorothioic Acid. VIII. Ultraviolet Spectra and Opposing Resonance in Phosphate Esters. VI. ***J. A. A. Ketelaar and H. R. Gersmann.*** VII. ***J. A. A. Ketelaar, H. R. Gersmann, and F. Hartog.*** VIII. ***H. R. Gersmann and J. A. A. Ketelaar.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 77, Nov. 1958, p. 973-989; 1018-1025.

3980* Tripyridyl Carbinols: A Group of Tertiary Alcohols With Amphoteric Properties. Synthesis of five new tripyridyl carbinols is described. The connection between structure and acid properties is discussed. ***J. P. Wibaut and H. L. Otto.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 77, Nov. 1958, p. 1048-1063.

3981* Aldol Condensations With Butanone. Condensation takes place mainly at the methylene group of the ketone. The mechanism of the reaction is discussed. ***M. G. J. Beets and H. Van Essen.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 77, Nov. 1958, p. 1138-1152.

3982* Chemistry of Acetylenic Ethers. XXXIII. The Addition of Ethoxyethyne to Diphenylketene. XXXIV. On the Reactivity of Acetylenic Ethers and Thioethers; the Dual Character of Alkylthio Groups. XXXIII. ***J. Nieuwenhuis and J. F. Arens.*** XXXIV. ***H. C. Volger and J. F. Arens.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 77, Nov. 1958, p. 1153-1188.

3983* On the Preparation of *p*-Oxyphenyl-diphenylsulfide, Diphenylsulfone and Corresponding Mono-nitro, -Amino, and Acetylamino Derivatives. (*In Italian.*) Sulla preparazione del *p*-ossifenil-difenilsolfuro, -difenilsolfone e corrispondenti mono-nitro, -amino ed -acetilamino derivati. ***Antonino Arcoria and Riccardo Passerini.*** *Ricerca Scientifica*, v. 28, Sept. 1958, p. 1842-1846.

3984* The Organic Chemistry of Sulphur in the Kraft Process. I. Pine Thiolignin as a Mixture. II. Nature of the Sulphur Linkages in Pine Thiolignin. I. ***L. Field, P. E. Drummond, P. H. Riggins, and E. A. Jones.*** II. ***L. Field, P. E. Drummond, and E. A. Jones.*** *Tappi*, v. 41, Dec. 1958, p. 721-733.

3985* Ozonolysis of Naphthoquinones. I. Ozonolysis of 1:4-Naphthoquinone in Chloroform. ***Erling Bernatek.*** *Tetrahedron*, v. 4, nos. 3-4, Nov. 1958, p. 213-222.

3986* The Chemistry of Cadinenes and Cadinols. Sesquiterpenoid hydrocarbons, the cadinenes, and tertiary alcohols, the cadinols, have been isolated in a pure state. Their constitution and absolute configuration have been established. ***V. Herout and V. Sýkora.*** *Tetrahedron*, v. 4, nos. 3-4, Nov. 1958, p. 246-255.

3987* Stereochemistry of the Co-Oxidation Products of Indene and Thiophenol. ***J. F. Ford, R. C. Pitkethly, and V. O. Young.*** *Tetrahedron*, v. 4, nos. 3-4, Nov. 1958, p. 325-326.

3988* Silanols. I. Stability and Condensation Behavior of Organosilane-diols. The condensation reactions of organosilanediols were investigated by physicochemical measurements. The observed differences of condensation behaviors are discussed on the basis of bond theory. On hydrolyzing di-*p*-chlorophenyldichlorosilane, condensation products of low molecular weights were found in addition to di-*p*-chlorophenyl-silanediol formed primarily. (*In German.*) Silande. I. Stabilität und Kondensationsverhalten von Organosilandiolen. II. Kondensationsprodukte des Di-p-chlorphenylsilandiols. ***G. Schott and H. Berge.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 297, nos. 1-2, Oct. 1958, p. 32-47.

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3989 The Ionization and Dissociation of Oxygen by Electron Impact. All the spectroscopically known excited states of molecular oxygen have been observed. ***D. C. Frost and C. A. McDowell.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6183-6187.

3990 Infrared Spectra and Strain in Cyclic Carbonyl Compounds. ***H. K. Hall, Jr. and R. Zbinden.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6428-6432.

3991 The Nature of the Silicate Species in Sodium Silicate Solutions. An analysis of the literature data and e.m.f. and conductance measurements of the present study was made to determine the degree of polymerization of the silicate ions. ***S. A. Greenberg.*** *American Chemical Society, Journal*, v. 80, Dec. 20, 1958, p. 6508-6511.

3992 Heats of Dilution and Related Thermodynamic Properties of Aqueous Rare Earth Salt Solutions at 25°; Integral Heats of Solution of $NdCl_3 \cdot 6H_2O$. Results are compared to theoretical predictions and to previous measurements. ***F. H. Spedding, A. W. Naumann, and R. E. Eberts.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 23-28.

3993 The Heat Capacity of Sulfur From 25 to 450°, the Heats and Temperatures of Transition and Fusion. ***Estal D. West.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 29-37.

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COATINGS

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4079* Ceramic Coatings for Protection of Metals at High Temperatures. Protection by high temperature-resistant enamels, refractory paints and flame sprayed, high melting oxides and cermets. Examples are presented. *(In German.)* Keramische Überzüge als Hochtemperatur-Korrosionsschutz für Metalle. ***Armin Petzold.*** *Werkstoffe und Korrosion*, v. 9, Dec. 1958, p. 761-765.

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See also: **3851** (protection of steel by painting in Sweden); **3852** (pigment dispersion); **4357** (coatings for Ti); **4391** (coatings in aircraft corrosion control); **4860** (joining of clad steels).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

4081* On Matrix Program Schemes. A study of matrices giving the order of performances and of their use in the theory of program schemes. ***Iu. I. Ianov.*** *Association for Computing Machinery, Communications*, v. 1, Dec. 1958, p. 3-6.

4082* Equipment Evaluation for Data Input System Design. This concluding part of a two-article series is concerned with system design factors for successful data recording, equipment available, manufacturers, and the points that should be covered in an evaluation study. ***Roger L. Sisson.*** *Automation*, v. 6, Jan. 1959, p. 64-71.

4083* 10-Bit Resolution in Shaft-Position to Digital Encoder. Describes a newly designed encoder with an efficient accurate shaft-position to digital conversion. Using logic circuitry and a unique double track for the least significant figure, it provides extended range to the applications of this essential component for computing and data processing systems. ***W. E. Stupar.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 138-141.

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4085 Engineering Systems Analysis. The definition and interpretation of engineering analogies is introduced and the dynamical analogies of resonance in mechanical, electrical, and acoustical systems are analyzed. One technique employed in the solution of dynamical system problems is the generalized or *dimensionless ratio* approach which is useful in many engineering problems. Application to dynamical systems is a natural introduction to the study of dimensional analysis, which is found to be a powerful aid in studying many physical problems. ***Robert L. Sutherland.*** 223 pp. 1958. Addison-Wesley Publishing Company, Reading, Mass. (TA277 Su84e)

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4088 Soviet Trends in Computers for Control of Manufacturing Processes. Presents a clear and thorough résumé of the state of Soviet computer art. This final installment covers process control computers. ***V. B. Ushakov.*** *Instruments and Automation*, v. 32, Jan. 1959, p. 102-105.

4089 Logic Machines and Diagrams. A logic machine is a device designed specifically for solving problems in formal logic. A logic diagram is a geometrical method for doing the same thing. Shows how symbolic logic can be applied fruitfully to the design and simplification of switching circuits and how electronic calculators often require elaborate logic units. Much of this material is from relatively inaccessible books and journals. ***Martin Gardner.*** 157 pp. 1958. McGraw-Hill, New York. (BC138 G17L)

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4092* Electronic Computer Exhibition. A brief review of new developments in digital circuitry and input/output equipment. *Wireless World*, v. 65, Jan. 1959, p. 17-21.

See also: **4362** (computers for highway engineering); **4487** (tape-controlled machining).

ELECTRICAL ENGINEERING

4093* Designing Rectifier Transformers With Phase Shift. Describes how novel winding arrangement in rectifier transformer eliminates separate phase-shifting unit. Design improves regulation and efficiency, and simplifies station layout. ***John A. Ebert.*** *Allis-Chalmers Electrical Review*, v. 23, no. 4, 1958, p. 14-17.

4094* Applying Capacitors at Motor Terminals. Describes how to find a maximum safe capacitive reactance that may be applied to induction motors for power-factor correction. ***R. C. Moore and W. E. Schwartzburg.*** *Allis-Chalmers Electrical Review*, v. 23, no. 4, 1958, p. 20-22.

4095* Designing Optimum Inductors With Ferrite-Biased Gaps. Analysis and synthesis techniques presented enable designers to proceed directly from electrical specifications to physical dimensions of optimum inductors with iron (Audio A) or ceramic (Ferramic H) cores - with ferrite gaps, air gaps or no gaps, whichever is optimum for the particular case. ***J. T. Ludwig.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 78-90.

4096* Research Progress in Dielectrics—1958. Annual review and interpretation of the Conference on Electrical Insulation, Division of Engineering and Industrial Research, NAS-NRC. Summary of trends and viewpoints. ***Alex E. Javitz.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 91 + 9 pages.

4097* Non-Linear Resistors as Voltage Regulators. A method is presented for rational and graphic analysis of circuits using non-linear resistors. ***J. Zdzieborski and R. E. Post, Jr.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 152-155.

4098* Use of Epoxy Resin in High Reliability Transformers. Describes improvement in the reliability of miniaturized transformers which has been brought about by complete impregnation of the transformer in specially compounded epoxy resin. ***Wallace W. Wahlgren.*** *Electronic Equipment Engineering*, v. 7, Jan. 1959, p. 57-58.

4099 Application of a Method of Inspection Testing to Assurance Reliability. This paper describes the use of a sampling method of inspection testing for the purpose of controlling reliability in a system. The acceptance quality level (AQL) and mean failure free time can be estimated by the maximum likelihood method, assuming that errors are distributed by the Poisson Law. ***N. M. Peterson.*** *IRE Transactions on Reliability and Quality Control, PQRQC*-15, Dec. 1958, p. 19-26. (TK1 In6.6q Vis.)

4100 A Reliability Analysis of the Effects of Nuclear Radiation on the Electrical Properties of Capacitors. The purpose of this paper is to establish an attitude toward the radiation damage of capacitors where mixed reactor fluxes of both gamma photons and high energy neutrons are impinging upon the dielectric materials. ***R. R. Paddock.*** *IRE Transactions on Reliability and Quality Control, PGRQC*-15, Dec. 1958, p. 27-33. (TK1 In6.6q Vis.)

4101 Multienvironmental Life Testing of Parts and Components in Rockets and Guided Missiles by Statistical Design. Describes an investigation of the behavior pattern of the items over the environmental space carried out by combining censored life testing with statistical experimental designs and illustrating the results by response surfaces. ***D. Kevan Lloyd.*** *IRE Transactions on Reliability and Quality Control, PGRQC*-15, Dec. 1958, p. 34-42. (TK1 In6.6q Vis.)

4102 Setting Up a Standardization Laboratory. Describes the step-by-step procedure for starting and equipping a standards laboratory. Tables list actual equipment selected from one

such laboratory. ***Philip Greenspan and James Reece.*** *Instruments and Automation*, v. 32, Jan. 1959, p. 94-99.

See also: **4745** (cable materials).

ELECTROCHEMISTRY

4103 The Structure of Electro-Deposited Nickel. An electron diffraction study was made on the crystal structure, orientation, and mode of growth of Ni deposits from sulfate-chloride-boric acid and chloride-boric acid baths under various bath conditions. The effect of pH, temperature, concentration, current density, mechanical stirring, etc. and of additions such as hydrogen peroxide, nickel nitrate, and sodium chloride was investigated on poly-crystalline substrates. ***B. C. Banerjee and A. Goswami.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 20-23.

4104 Electrodeposition of High-Purity Chromium. Thick chromium deposits were prepared by the electrolysis of aqueous chromic acid baths. Metal containing 0.005% oxygen, less than 0.002% nitrogen, and only traces of metallic impurities was obtained upon electrolysis of purified solutions at elevated temperatures. After consumable electrode arc-melting, this type of chromium could be hot-worked to rod and drawn to wire that was ductile at room temperature. ***F. E. Block, P. C. Good, and G. Asai.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 43-47.

4105* Titanium/Platinum Anodes Developed. The disadvantages of titanium as an anode material can be largely overcome by bringing it into contact with platinum, either in the form of strip or wire or as a thin film. *Industrial Finishing (London)*, v. 11, Jan. 1959, p. 49.

4106 Cr-Ni Plate Guards Molybdenum. A two-layer electrodeposited coating will protect molybdenum from oxidation at elevated temperatures. *Iron Age*, v. 183, no. 2, Jan. 8, 1959, p. 62-63.

4107 Ultrasonic Plating. Ultrasonics are being used in connection with both electrical and electroless plating operations and where electroless work is done, they have the principal advantage of improving both the plating rate and the lustre of metal finishes. Since finishes deposited by ultrasonically-vibrated electroless solutions have exceptional brightness and lustre, it is apparent that plating speed in the latter instances is mainly the result of cavitational effects which allow superior wetting action. *Metal Industry*, v. 94, Jan. 9, 1959, p. 27-28.

4108 Titanium-Platinum Anodes. Titanium, though virtually immune to corrosion in brine, is not a suitable anode material because the protective oxide film which forms on its surface resists the passage of an electric current. Attempts to force a passage by using high voltages may result in failure of the film and severe local corrosion. Research has shown, however, that this high resistivity is very much reduced when titanium is brought into electrical contact with a second metal. In particular, contact with platinum, deposited on the titanium either in strip or wire form or as a thin film, produces a very effective electrode system. *Metal Industry*, v. 94, Jan. 9, 1959, p. 28.

4109 Anodized Aluminium Windings. *Metal Industry*, v. 94, Jan. 16, 1959, p. 48.

See also: **4032** (Cr electrodeposits); **4080** (tinning of wire); **4391** (aircraft corrosion control); **4465** (electroplating of shot-peened alloy steel).

ELECTRONICS

4110 Broad-Band Oscilloscope—An Application. Describes an experimental system for studying extremely fast electrical pulses. The system employs television techniques and a new traveling-wave oscilloscope tube. ***A. F. Dietrich.*** *Bell Laboratories Record*, v. 37, Jan. 1959, p. 20-22.

4111 On the Design of the Transition Region of Axisymmetric, Magnetically Focused Beam Valves. An analysis of the design of the transition region of an axially symmetric beam-type device. Using an analogue computer, beam envelopes are presented for Brillouin flow, magnetic focusing, and space-charge-balanced flow. ***V. Bevc, J. L. Palmer, and C. Süsskind.*** *British Institution of Radio Engineers, Journal*, v. 18, Dec. 1958, p. 696-708.

4112* Radar Systems With Electronic Sector Scanning. Discusses the application to radar of a system of electronic sector scanning, recently described in relation to underwater acoustic echo-ranging. ***D. E. N. Davies.*** *British Institution of Radio Engineers, Journal*, v. 18, Dec. 1958, p. 709-713.

4113* The Characteristic Impedance and Phase Velocity of High-Q Triplate Line. The derivation of the impedance and phase velocity for high-Q triplate line is considered and an exact solution is obtained for the impedance in the absence of the dielectric support sheet. An expression derived for the phase velocity of the waves in the line is compared with experimental values and it is shown that the agreement is sufficiently close for design purposes. ***K. Foster.*** *British Institution of Radio Engineers, Journal*, v. 18, Dec. 1958, p. 715-723.

4114* Properties of Hook Transistors in Switching and Amplifying Circuits. The circuit propetries of hook and *p-n-p-n* transistor configurations are examined for applications to switching circuits and to linear amplifiers. Using two- and four-terminal switching circuits of the open-circuit stable or of the short-circuit stable type, stable amplifiers with remarkable characteristics can be obtained. ***L. M. Vallese.*** *British Institution of Radio Engineers, Journal*, v. 18, Dec. 1958, p. 725-732.

4115* Electromagnetic Wave Propagation in Cylindrical Waveguides Containing Gyromagnetic Media. III. ***R. A. Waldron.*** *British Institution of Radio Engineers, Journal*, v. 18, Dec. 1958, p. 733-741.

4116 European Developments in Electronic Components. Magnetic materials, capacitors, resistors, potentiometers, batteries, and other areas are reviewed here. ***G. W. A. Dummer.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 131-135.

4117 Metallized Glass-Fiber Resistors—a British Development. Construction, characteristics, and applications of metallized glass-fiber resistors is described. ***G. W. A. Dummer and C. M. Benham.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 135-137.

4118* High-Temperature Capabilities of Germanium Transistors. Shows that temperature stabilization techniques can provide reliable short-term operation in small-signal amplifiers at 110 C or higher. ***J. O. Dick.*** *Electrical Manufacturing*, v. 63, Jan. 1959, p. 149 + 3 pages.

4119* Testing Diodes for R. F. Noise. Discussed semiconductor diode transients and the noise effect on them at radio frequencies. Minimizing the interference can be accomplished only by selecting low-noise diodes by actual tests. Selection for noise tests and test results are described. ***J. C. Senn.*** *Electronic Equipment Engineering*, v. 7, Jan. 1959, p. 28-32.

4120* Measuring Load Characteristics of Silicon Cells. Describes evaluation of the performance characteristics of silicon rectifying cells. This circuit requires a minimum number of components and can be inserted in any type of rectifier circuit. ***Robert D. Lynch.*** *Electronic Equipment Engineering*, v. 7, Jan. 1959, p. 33-34.

4121* Miniature Resonators for UHF. An investigation of extent of miniaturization possible in coaxial resonators and practical design that provides high Q and high impedance required in present day uhf applications. Data on several sample cavities given in illustrations. ***Irving Dlugatch.*** *Electronic Equipment Engineering*, v. 7, Jan. 1959, p. 35-37.

4122* Predicting Relay Reliability. Unique technique for measuring forces of a relay permits the design of units with predictable reliability. Electrical balancing of forces involved provides direct read-out on an x-y plotter. ***T. Ross Welch.*** *Electronic Equipment Engineering*, v. 7, Jan. 1959, p. 53-55.

4123 Focusing Traveling Wave Tubes. Describes a method of periodic electrostatic focusing of traveling wave tubes which eliminates the focusing permanent magnets and also the problem of aligning the tube in the magnetic field. ***Donald J. Blattner and Frank E. Vaccaro.*** *Electronic Industries*, v. 18, Jan. 1959, p. 58-61.

4124 High Accuracy Time Interval Measurements. A system is described which makes possible measurements with 0.01 μsec. accuracy between events taking place in widely separated locations. Complete design information is given to permit constructing this system. ***Herbert D. Tanzman.*** *Electronic Industries*, v. 18, Jan. 1959, p. 62-67.

4125 Constant-Resistance All-Pass Networks With Maximally Flat Time Delay. Some constant-resistance all-pass network with maximally flat delay are made available with little or no computation. The tables in the paper are directed primarily to those engineers without synthesis background. ***Louis Weinberg.*** *Franklin Institute, Journal*, v. 267, no. 1, Jan. 1959, p. 35-53.

4126 A Survey of Speech Bandwidth Compression Techniques. The paper presents brief descriptions of several speech bandwidth compression techniques which are currently being employed or investigated to achieve varying degrees of compression. Also a method of estimating the influence of signal-to-noise ratio on a communications link employing such compression techniques is presented. ***S. J. Campanella.*** *IRE Transactions on Audio*, v. AU-6, no. 5, Sept.-Oct. 1958, p. 104-116. (TK1 In6.6au Vis.)

4127* Detection of Moving Radar Targets in Clutter. The moving target indicator is investigated for threshold power and visibility in clutter. In search for improvements, electronic scanning of the antenna beam is proposed and a detector is considered combining more than two pulses at a time. ***Lars-Henning Zetterberg.*** *Information and Control*, v. 1, no. 4, Dec. 1958, p. 314-333.

4128* Recent Advances in Solid State Receivers. Reviews some recent engineering advances in the solid state field and discusses the present and possible future characteristics of mavar and maser receivers. ***Wesley G. Matthei.*** *Microwave Journal*, v. 2, Jan. 1959, p. 19-24.

4129* Using the Smith Diagram. Describes how the Smith diagram is put together and how one solves problems by its use. ***George C. Southworth.*** *Microwave Journal*, v. 2, Jan. 1959, p. 25-31.

4130 Optical Method for Determining Carrier Lifetimes in Semiconductors. The method is based on determination of the mean transmittance as a function of the mean life of photoliberated carriers. The method can be used for determining both the lifetime and diffusion length for electrons and holes independently of each other. ***Lennart Huldt.*** *Physical Review Letters*, v. 2, no. 1, Jan. 1, 1959, p. 3-5.

4131 Energy Loss Processes in Ferroelectric Ceramics. By a study of aging effects in which permittivity, elastic compliance and the electrical and mechanical loss coefficients decrease with time, the principal ferroelectric loss process in low fields is identified as microhysteresis associated with small-amplitude domain boundary movement. ***B. Lewis.*** *Physical Society, Proceedings*, v. 73, pt. 1, Jan. 1959, p. 17-24.

4132 1/*f* Noise in Germanium Devices. A study of noise in the breakdown region of a reverse biased p-n junction was carried out, and a noise model suggested by one of the theories tentatively proposed. ***T. B. Watkins.*** *Physical Society, Proceedings*, v. 73, pt. 1, Jan. 1959, p. 59-68.

4133* On the Quality of Color-Television Images and the Perception of Color Detail. A theoretical and experimental study of the NTSC color system shows that contrast range and color saturation obtained with commercial tricolor kinescopes provide a larger color space than provided by color motion pictures. ***Otto H. Schade.*** *Society of Motion Picture and Television Engineers, Journal*, v. 67, Dec. 1958, p. 801 + 17 pages.

4134 The Application of Solid-State and Other New Components in Circuits for Nuclear Instruments. A survey of the field of nuclear circuit advances that have come about as the result of superior transistors, other solid-state devices, magnetic materials, and the general improvements of techniques. Some developmental low-background counting arrangements and their applications are illustrated. ***H. D. LeVine.*** *U. S. Atomic Energy Commission, TID*-7557, Dec. 1958, p. 96-116. (UF767 Un3ti Contin.)

4135 Recently Developed Components for Application to Nuclear Electronic Equipment. Describes some new components that can be used in the design of nuclear equipment. The expanding transistor component field, the subminiature parts, and special-purpose vacuum and photoemissive tube types are described. ***H. D. LeVine.*** *U. S. Atomic Energy Commission, TID*-7557, Dec. 1958, p. 117-139. (UF767 Un3ti Contin.)

4136* Stereophonic Record Pickups. A brief review of the basic principles embodied in the design of stereophonic record pickups. ***F. Oakes and D. V. Charlesworth.*** *Wireless World*, v. 65, Jan. 1959, p. 2-6.

4137* Automatic Error Correction. Reviews repetition methods in multiplex radio teleprinters. ***P. R. Keller and L. K. Wheeler.*** *Wireless World*, v. 65, Jan. 1959, p. 28 + 5 pages.

4138* The "Third Method". An analysis of a new system of single sideband generation. ***J. F. H. Aspinwall.*** *Wireless World*, v. 65, Jan. 1959, p. 39-43.

See also: **4649** (semiconductor monocrystals).

ENGINEERING ECONOMICS

4139 Need Help With Market Research? Your Biggest Answer Man—Uncle Sam. ***Frank M. Kleiler.*** *American Business*, v. 29, Feb. 1959, p. 17-19.

4140* Capital Costs of Process Vessels, Heat Exchangers and Distillation Equipment. Presents up-to-date information on such equipment and suggests "short cut" factors for various materials of construction and for various operating pressures. ***B. Pollard, E. V. Wood, and J. Carter.*** *British Chemical Engineering*, v. 4, Jan. 1959, p. 22-23.

4141* How Seasonally Adjusted Statistics Can Help You in Making Forecasts. Use of an electronic computer makes it possible to do necessary calculations within hours. ***Helen Foster Moore.*** *Canadian Business*, v. 32, Jan. 1959, p. 50-53.

4142 Determination of Arc Welding Costs. II. Describes methods by which manual work elements may be controlled in today's arc welding operations. ***S. R. Kerr.*** *Canadian Metalworking*, v. 22, Jan. 1959, p. 36 + 3 pages.

4143 What Today's Cost Engineer Needs. Despite a wealth of good information useful to cost engineers, there are still some voids to be filled in. ***Cecil H. Chilton.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 131-132.

4144 Industry and the Atom: What Price Nuclear Power? Economic roadblocks that must be cleared away before atomic power goes to work for industry. ***Ernest Le Monnier.*** *Dun's Review and Modern Industry*, v. 73, no. 1, Jan. 1959, p. 37 + 7 pages.

4145 How to Cut Costs Through Quality Control. How to track down the source of scrap and salvage items, plus other ideas for improving quality control. Eight steps are listed. ***R. C. Trundle, Jr.*** *Iron Age*, v. 183, no. 2, Jan. 8, 1959, p. 72-74.

4146 Auditing Product Programs. What to look for in setting up and maintaining a practical running inventory of the status of the company's "product portfolio". ***Philip Marvin.*** *Machine Design*, v. 31, Jan. 8, 1959, p. 106-111.

4147* The Free World's Stake in Aluminum. Russia's role in the market. ***Nathanael V. Davis.*** *Metals*, v. 29, no. 7, Jan. 1959, p. 10 + 2 pages.

4148* Coal and the Electric Power Industry. Estimates that by 1975 the annual coal requirement of the electric utilities will be between 400 and 500 million tons based on the belief

that coal suppliers will keep alert to the use of improved machinery and mining methods to produce coal at the lowest possible cost. ***Eugene Gordon.*** *Mining Congress Journal*, v. 45, Jan. 1959, p. 25-27.

4149* **Plastics Stalk Aluminum in Drive for Tonnage Markets.** A stiff competitive battle is shaping up as plastics and Al industries seek markets for excess capacity. ***M. J. Schmidt.*** *Modern Metals*, v. 14, no. 12, Jan. 1959, p. 42 + 2 pages.

4150 **Perspectives on Conservation.** A series of essays shedding light on the resource problems of the next fifty years from the vantage point of a critical review of the past fifty. ***Henry Jarrett, Editor.*** 260 pp. The Johns Hopkins Press, Baltimore. (HC103.7 R31p)

4151* **Current Economic Developments in Europe.** Covers trends to mid-1958. *United Nations, Economic Bulletin for Europe*, v. 10, no. 3, Nov. 1958, p. 1-42.

4152* **The Japanese Economy.** After the total collapse in 1945 Japan needed ten years to put its economy once again on a healthy basis and 1956 was the "year of economic recovery". Success led to an over-estimation of the economic potentialities and powers; and the Kishi cabinet was obliged to steer a restrictive course since the Spring of 1957. (*In German.*) Die japanische Wirtschaft. ***Adolf Reisser.*** *VDI Zeitschrift*, v. 101, no. 3, Jan. 21, 1959, p. 97-102.

See also: **3818** (economics of interior insulation); **3850** (markets for plastics–1958); **4211** (economics of gas vs. electricity); **4214** (ocean transport of LPG); **4244** (non-ferrous ore deposits in Ireland and Scotland); **4264** (economy of improved oil-recovery in Oklahoma); **4303** (atomic power competition); **4304** (scheduling the use of water power).

FLUID MECHANICS

4153 **Turbulent Heat Transfer Inside Tubes and the Analogy Among Heat, Mass, and Momentum Transfer.** An experimental heat transfer study of the heretofore undefined region of high Prandtl number was performed. Fluid properties, determined experimentally, represented a variation in Prandtl number from 50 to 600. For final correlation all the available data for heat transfer with moderate temperature differences except those on liquid metals were considered. The effect of the Prandtl number for the range of the data (N_{Pr} of 0.50 to 600) was not well represented by any of the generally accepted theories or empirical equations, although a semitheoretical correlation was deduced from the data with Reichardt's general formulation of the analogy between heat and momentum transfer. The resulting equation fits all the available data with a standard deviation of 9.4%. The applicability of the correlation to turbulent mass transfer in tubes is demonstrated for Schmidt numbers up to 3,000. ***W. L. Friend and A. B. Metzner.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 393-402.

4154 **On Phase Equilibrium at the Gas-Liquid Interface During Absorption.** Accurate measurements are reported herein of the absorption rates at 25 C of CO_2 into short water jets in which the liquid was in laminar flow. The measured rates are in excellent agreement with predictions based on unsteady state diffusion theory, assuming interfacial equilibrium. Concludes that equilibrium prevails at a freshly formed, relatively clean, CO_2-water interface and that the same statement probably applies to the absorption of other slightly soluble gases in water. Minute quantities of surface-active materials may seriously reduce the rate of gas absorption. ***L. E. Scriven and R. L. Pigford.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 439-444.

4155 **Flow Patterns of Liquids in Agitated Vessels.** Flow patterns of liquids in an agitated vessel of 11½-in. I.D. were measured with the Co-60 radioisotope. Flow patterns of paddle, turbine, and propeller, were studied using water and glycerine solutions. Effects of geometrical factors of agitated systems on flow patterns were investigated. A curve showing the relation between flow patterns and power consumption by the agitation was made. ***Shuichi Aiba.*** *A.I.Ch.E. Journal*, v. 4, no. 4, Dec. 1958, p. 485-489.

4156 **Tables of the Speed of Sound in Water.** An equation and tables are reprinted from the *Journal of Research of the National Bureau of Standards.* ***Martin Greenspan and Carroll E. Tschiegg.*** *Acoustical Society of America, Journal*, v. 31, Jan. 1959, p. 75-76.

4157* **Oscillations in the Wake of a Moving Body.** A linear hydrodynamic theory of stability is submitted and substantiated. (*In Russian.*) Obrazovanie kolebaniĭ v slede za telom. ***V. N. Arkhipov.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 4, Dec. 1, 1958, p. 620-622.

4158* **Experimental Investigation of Hydraulic Resistance in a Concrete Channel (Trough) With a Cement Floor.** An analysis of the results of investigations of the resistances in tubes and troughs made of various materials; concludes that hydraulic resistances in a smooth channel depend on the surface material. (*In Ukrainian.*) Eksperimental'ne doslidzhennia gidravlichnogo oporu v betonnomu kanali (lotoku) z zaliznenoiu poverkhneiu. ***I. A. Rodionov.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1958, no. 11, p. 1186-1189.

4159* **Flow Discharge Measurement With the Outflow Method.** Determination of the outflow coefficient of the nozzles of an outflow measuring device "Danaide", having 20 nozzles with quarter circle border lines. The coefficient rises with increasing Reynolds number but it is independent from the height of outflow and from surface tension. (*In German.*) Flüssigkeitsmengenmessung nach der Ausflussmethode. ***H. Rögener, E. Lau, and H. Löffel.*** *Brennstoff-Wärme-Kraft*, v. 11, no. 1, Jan. 1959, p. 30-33.

4160 **Horizontal Pipeline Flow of Mixtures of Oil and Water.** Study of flow characteristics in a horizontal, smooth, one-inch pipe. ***T. W. F. Russell, G. W. Hodgson, and G. W. Govier.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 9-17.

4161 **The Effect of the Less Viscous Liquid in the Laminar Flow of Two Immiscible Liquids.** ***T. W. F. Russell and M. E. Charles.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 18-24.

4162 **Ultimate Velocity of Drops in Stationary Liquid Media.** Study of the effects of high field viscosity and of low interfacial tension on the terminal velocity of single liquid drops falling through stationary liquid fields. ***M. Warshay, E. Bogusz, M. Johnson, and R. C. Kintner.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 29-36.

4163 **Tubeside Heat Transfer Coefficients.** Graphs to help solve problems dealing with heat transfer to and from gases and vapors. ***Ning Hsing Chen.*** *Chemical Engineering*, v. 66, Jan. 12, 1959, p. 124-126.

4164* **Confined Jets and Recirculation Phenomena With Cold Air.** Approximate theory of confined jets established by A. Craya and R. Curtet is developed. Two-dimensional and axisymmetric conditions are considered. Experimental results are given. Agreenment between theory and practice is examined. ***R. Curtet.*** *Combustion and Flame*, v. 2, no. 4, Dec. 1958, p. 383-411.

4165* **Supersonic Linearized Flow Around a Small Section Cone.** The cone surface was defined by reducing the calculation of the potential to the solution of a differential equation. (*In French.*) Écoulement supersonique linéarisé autour d'un cône de faible section. ***Robert Legendre.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 23, Dec. 10, 1958, p. 2094-2099.

4166* **Data of a Triparametric Scheme of Half Bodies of Revolution for the Flow Conditions at Sonic Flow and Linearized Supersonic Flow.** For slender half bodies of revolution a triparametric scheme is established. Hereto the velocity data at sonic flow, the wave drag data at any body length at $M_\infty = 1$ and in the linearized supersonic flow are given. The half body of revolution having minimum wave drag (minimum body) is mentioned with its flow data. Present calculations

consider no eventual shocks which may occur at the body. An example is given for the calculation of all important flow factors of these bodies. (*In German.*) Daten einer dreiparametrigen Systematik von Rotationshalbkörpern für die Strömungsverhältnisse bei Schallanströmung und linearisierter Überschallströmung. *Deutsche Versuchsanstalt für Luftfahrt, Berichte*, no. 70, Aug. 1958, 33 pp. + 5 tables.

4167* A New Characteristic Procedure for Single Dimensional Non-Stationary Flow. Shows procedure for non-stationary string flow with examples. The influence of cross-section modification on non-stationary pressure waves is determined, thus proving that a part of the wave is being reflected. It is shown how an inconstancy line at both sides of which the entropy being different, goes through a Laval jet. (*In German.*) Ein neues Charakteristikenverfahren für eindimensionale instationäre Strömungen. ***J. Teipel.*** *Deutsche Versuchsanstalt für Luftfahrt, Berichte*, no. 74, Aug. 1958, 37 pp.

4168 Flow Meter. Combines generation of the square root with the summing action of an all mechanical integrator to provide direct readings of total flow. *Electromechanical Design*, v. 3, no. 1, Jan. 1959, p. 4-6.

4169 Some Observations Concerning the Viscosity-Temperature Behaviour of Hydrocarbons. ***W. C. Winning.*** *Institute of Petroleum, Journal*, v. 45, Jan. 1959, p. 9-15.

4170* The Total-Count Technique: A New Principle in Flow Measurement. A new principle for measuring flow in all kinds of streams. ***D. E. Hull.*** *International Journal of Applied Radiation and Isotopes*, v. 4, nos. 1/2, Dec. 1958, p. 1-15.

4171* Transfer of Fluid Components in a Porous Medium at Constant Saturation and Fluid Velocity. When a gas is displaced by another in a porous medium, and there is a relative immobile liquid present, there is a transition zone in which the gas composition varies from essentially that of the original gas to that of the injected gas. The change in extent of this zone with time may be governed by a mixing process in the direction of flow and by the rate of establishment of gas-liquid equilibrium, if the gases are appreciably soluble in the liquid. The relative importance of these two factors is discussed. ***R. F. Nielsen and R. E. Gilchrist.*** *Journal of Petroleum Technology*, v. 11, Jan. 1959, p. 57-60.

4172 Viscosities of Liquid Mixtures. The viscosities of ten binary liquid systems were determined as a function of composition and of temperature in the range 25 to 45 C. The thermodynamics of these systems range from the ideal solution to partially miscible liquids. The free energy of mixing alone is insufficient thermodynamic information in attempting to correlate the thermodynamic behavior with the viscosity behavior of solutions. The volume change on mixing and the entropy of mixing each are related to separate viscosity effects. ***T. M. Reed, III and T. E. Taylor.*** *Journal of Physical Chemistry*, v. 63, Jan. 1959, p. 58-67.

4173* Hydraulic Significance of Transitional Behaviours of Flows in Channel Transitions and Controls. Application of geometric theory of differential equations to surface configuration of transition flow divergent or convergent channels. ***Yoshiaki Iwasa.*** *Kyoto University. Memoirs of the Faculty of Engineering*, v. 20, pt. 4, Oct. 1958, p. 237-276.

4174* Flow Patterns of Liquid in a Cylindrical Mixing Vessel Without Baffles. Measurement of the velocity distribution of agitated liquid in a vessel using a set of pitot tubes. Calculation of the power consumption in the neighborhood of an impeller, and comparison with that consumed in the outer region of the vessel. The discharging capacity can be accomplished to some extent by the proper design of an impeller. ***Shinji Nagata, Kazuo Yamamoto, and Motohiro Ujihara.*** *Kyoto University. Memoirs of the Faculty of Engineering*, v. 20, pt. 4, Oct. 1958, p. 336-349.

4175* Note on a Sphere Theorem for the Axisymmetric Stokes Flow of a Viscous Fluid. ***W. D. Collins.*** *Mathematika*, v. 5, pt. 2, no. 10, Dec. 1958, p. 118-121.

4176 Surface Wake of a Submerged Sphere. Sphere moving in a semi-infinite incompressible liquid with a free surface. ***Carl Eckart.*** *Physics of Fluids*, v. 1, no. 6, Nov.-Dec. 1958, p. 457-461.

4177 The Free Molecule Probe and Its Use for the Study of Leading Edge Flows. Development of a probe for use as an instrument in the investigation of two dimensional rarefied gas flow fields. ***J. A. Laurmann.*** *Physics of Fluids*, v. 1, no. 6, Nov.-Dec. 1958, p. 469-477.

4178* Flowing Fluids Do Strange Tricks. A few examples of actual behavior of gas flows show that a steady-flow energy analysis will not necessarily predict all of the results. ***B. G. A. Skrotzki.*** *Power*, v. 103, Feb. 1959, p. 144 + 3 pages.

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See also: **3820** (solids settling in hydraulic transport); **3823** (fluid systems in chemical engineering); **4675** (theory of fluids).

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4268 How Does A Raindrop Grow? Precipitation in natural clouds may develop from ice crystals or from large hygroscopic aerosols. ***Roscoe R. Braham, Jr.*** *Science*, v. 129, Jan. 16, 1959, p. 123-129.

4269 Smithsonian Contributions to Astrophysics. Three papers on the solar constant. *Smithsonian Contributions to Astrophysics*, v. 3, no. 3, 1958, 24 pp. (QB1 Sm69.1c Contin.)

4270* The Possible Use of Tritium for Estimating Groundwater Storage. Discussion of possible mixing mechanisms for water in the ground, evaluation of their importance and devising ways of computing groundwater storage from river water data on tritium. ***Erik Eriksson.*** *Tellus*, v. 10, no. 4, Nov. 1958, p. 472-478.

4271* East European Branch of the Polar Front as a Climatic Factor. Conclusions based on the study of synoptic charts. (*In Russian.*) Vostochno–evropeiskaia vetv' poliarnogo fronta kak faktor klimata. ***A. R. Sementsova.*** *Vsesoiuznoe Geograficheskoe Obshchestvo, Izvestiia*, v. 90, no. 6, Nov.-Dec. 1958, p. 543-545.

4272* A New Aqueous Uranium Silicate—Bilibinite. An amorphous analogue of black U silicates with a crystalline structure. (*In Russian.*) Novyĭ vodnyĭ silikat urana–bilibinit. ***E. Z. Bur'ianova.*** *Vsesoiuznoe Mineralogicheskoe Obshchestvo, Zapiski*, v. 87, ser. 2, no. 6, 1958, p. 667-674.

4273* Oil Discovery Techniques. II. Historical review and new techniques of oil discovery. *World Oil*, v. 148, Jan. 1959, p. 148-158.

4274* Drilling Practices. III. Historical review and new techniques of drilling practices. *World Oil*, v. 148, Jan. 1959, p. 159-180.

4275* Studies of Ancient Beaches Provide Clues in Oil Search. Ancient shore lines deserve detailed investigation since they are a source of clean sand with good permeability and are interstratified with potential oil forming environment. ***Warren C. Thompson.*** *World Oil*, v. 148, Jan. 1959, p. 227 + 4 pages.

4276* Material Balance Equations for Gas Reservoirs With Water Drive. A simple material balance and water influx equation. ***Jack R. Fraser and Arnold E. Campbell.*** *World Oil*, v. 148, Feb. 1, 1959, p. 63-65.

4277* Analyzing Mud Solids Saves Time and Money. Description of a method for estimating the actual clay content. ***P. W. Cooke.*** *World Oil*, v. 148, Feb. 1, 1959, p. 66-69.

4278* Use of Small Diameter Casing Reduces Well Costs. Successful slim hole completions are dependent on proper engineering considerations. Five thousand-foot wells equipped with 2⅞-inch casing are completed for approximately $8,000 less than similar wells equipped with 5½ inch casing. Consideration should be given to strength problems of the 1-inch pipe. A review of the analysis of J-55 and N-80 1-inch upset tubing indicates metallurgical strength considerably above that required for the imposed loads. ***Marion H. Stekoll and W. L. Hodges.*** *World Oil*, v. 148, Feb. 1, 1959, p. 70-74.

See also: **3856** (tar sand gasification).

GRAPHIC ARTS

4279* The Miraculous Bubble: A Look at Kalfax Microfilm. Based on a mylar film, a U. S. sensitive diezo dye, which decomposes into gas on exposure, permits complete processing in normal room light and quite rapid operation. ***Peter Scott.*** *Library Resources and Technical Services*, v. 3, no. 1, Winter, 1959, p. 40-46.

4280 Liminal Image Size for Conventional Film Readers. Small targets of various contrasts were examined to determine the smallest images which can be detected in a film reader. The study indicates that uncorrected predictions made on the basis of ordinary visual contrast discrimination data may be in error by an order of magnitude. ***H. I. Register and Alex G. Smith.*** *Optical Society of America, Journal*, v. 49, Feb. 1959, p.169-171.

4281 Detail Rendition by Photographic Systems as a Function of Exposure Time. Photographs were made using several photographic systems and it was found that the films of moderate and high speed recorded practically the same amount of detail for a given exposure time but that the document-copying films recorded much less. ***Robert N. Wolfe.*** *Optical Society of America, Journal*, v. 49, Feb. 1959, p. 172-175.

4282 Instrument for Thermal Photography. Utilizes infrared radiation passively emitted by objects at ambient temperature. Quantitative analysis of thermal photographs is described, and several examples of thermal photographs are given. ***Robert W. Astheimer and Eric M. Wormser.*** *Optical Society of America, Journal*, v. 49, Feb. 1959, p. 184-187.

4283* Interchangeable Lenses for Camera With Blade-Shutters. Discusses differences of focal plane and blade shutters and the advantages of interchangeable lenses for the latter. (*In German.*) Wechselobjektive an Kameras mit Sektorenverschlüssen. ***Paul Fahlenberg.*** *Photo-Technik und-Wirtschaft*, v. 10, Jan. 1959, p. 8-10.

4284* Shutter Image Converter Tube for Multiple-Frame Photography. A shutter tube is described which is capable of delivering 16 frames on the viewing screen, utilizing electrostatic focusing and electromagnetic deflection. This tube employs an Sb-Cs (O) photocathode formed by external Sb-evaporation, a cascaded focusing system, deflection yokes which are assembled around the neck of the tube, a lumped PDA system, and a yellow-green modified P20 phosphor for the viewing screen. ***William O. Reed and Wilfrid F. Niklas.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Jan. 1959, p. 1-5.

4285* A Method of Measuring the Steadiness of Motion-Picture Cameras. The unsteadiness of cameras can be evaluated by a double-exposure technique using a "step-wedge" shaped object for the first target and a simple bar for the second. The results are obtained in the form of individual, whole values. ***A. C. Robertson.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Jan. 1959, p. 21-25.

HEAT POWER

4286 Blackburn's Free-Turbine A.129. Description, development plans, technical data. *Aeroplane*, v. 95, Dec. 26, 1958, p. 928-931.

4287 Statistical Evaluation of Near-Field Sound Pressures Generated by the Exhaust of a High-Performance Jet Engine. Occurrence of peak pressures does not follow a Rayleigh Distribution. Peak pressure distribution is not altered by the physical position related to the jet stream nor does it appear to be a function of frequency. A maximum ratio of peak to rms pressure is shown to exceed four, but a physical limit is not established. ***Edwin C. Kamps.*** *Acoustical Society of America, Journal*, v. 31, Jan. 1959, p. 65-67.

4288* Those Little Gasoline Engines. Uses of fractional h.p. engines. ***Gardner Soule.*** *American Petroleum Institute Quarterly*, Autumn 1958, p. 28-33.

4289* Nuclear Combustion Plasmas and Magnetic Nuclear Combustion Chambers for Jet Propulsion. The properties of fusion and fission plasmas in connection with rocket propulsion. Special arrangements of magnetic fields are proposed for confining the plasmas. Methods for direct conversion of nuclear into electrical energy are considered. (*In German.*) Kernverbrennungsplasmen und magnetische Kernbrennkammern für Strahltriebwerke. ***F. Winterberg.*** *Astronautica Acta*, v. 4, no. 4, 1958, p. 235-263.

4290 Atomization in High Velocity Air Streams. An experimental study to simulate fuel injection in turbojet afterburners and in ramjets; a knowledge of the drop sizes obtained would help in the design of jet engines and their fuel systems. ***Malcolm A. Weiss and Charles H. Worsham.*** 347 pp. May 1958. Esso Research and Engineering Co., Linden, N. J. (TC173 Es79a Over.)

4291* Small Gas Turbine Development. Description of new areas of engineering research. ***Henry C. Hill.*** *Australasian Engineer*, 1958, Nov. 7, p. 62-66.

4292 Intercooling of Supercharged Engines. ***A. D. Bogus.*** *Automotive Industries*, v. 120, no. 2, Jan. 15, 1959, p. 64 + 2 pages.

4293* Indirect Preheating of Combustion Air. Experiments on indirect air preheating by means of recirculated water preheaters have resulted in well developed designs increasing the safety of operation and efficiency of the plant. (*In German.*) Mittelbare Vorwärmung der Verbrennungsluft. ***Alberts Upmalis.*** *Brennstoff-Wärme-Kraft*, v. 10, Dec. 1958, p. 569-571.

4294* Automatic Control of Sulzer Reheat Monotube Steam Generators. Description of generators where hydraulic elements are used for the immediate controls and electric elements for precision control. (*In German.*) Die Regelung von Sulzer-Einrohrdampferzeugern mit Zwischenüberhitzung. ***M. Diethelm.*** *Brennstoff-Wärme-Kraft*, v. 11, no. 1, Jan. 1959, p. 3-7.

4295* Experimental Study of a Reversed Jet Flameholder. Experiments and analyses contributing to a basic understanding of a flame held in a stream of a combustible gas by a small gas jet directed upstream. ***G. A. Agoston, A. W. Noon, T. D. Witherly.*** *Combustion and Flame*, v. 2, no. 4, Dec. 1958, p. 333-347.

4296* Gas Turbines and Jet Drives for Helicopters (State of the Problem up to June 1956). Review of gas turbine and jet drives for rotors. State of helicopter drive engineering (operation, efficiency, weight). Tabulation of drives. List of literature. (*In German.*) Gasturbinen und Strahlantriebe für Hubschrauber. ***H. Lüpke.*** *Deutsche Versuchsanstalt für Luftfahrt, Berichte*, no. 46, Jan. 1958, 107 pp.

4297* A-C's 16000 and 21000 Engines. New features including a brand new combustion system. *Diesel Power*, v. 37, Jan. 1959, p. 36-38.

4298* Driving a Diesel Car. Operation, performance and economics. ***Brian P. Emerson.*** *Diesel Power*, v. 37, Jan. 1959, p. 39 + 2 pages.

4299* Cummins Adds Two Small Engines. The low-power J-70 and J-80 units. *Diesel Power*, v. 37, Jan. 1959, p. 57 + 1 page.

4300* Efficiency of Locomotive Smokeboxes. A basis of relative static efficiency is proposed which would enable the working of different smokeboxes to be compared, and related to the reduction of power of the engine proper due to back pressure. ***H. I. Andrews.*** *Engineer*, v. 206, Dec. 26, 1958, p. 1008-1012.

4301 Heat Exchangers. Applications to Gas Turbines. Design, construction, and properties of heat exchangers and air preheaters; influence on turbine performance; material and cost factors. ***W. Hryniszak.*** 343 pp. 1958. Academic Press, New York. (TJ778 H85h).

4302 Chrysler Reports on Turbines. Progress made in the development of the experimental gas turbine engine. ***H. R. Neal.*** *Iron Age*, v. 183, no. 3, Jan. 15, 1959, p. 57 + 1 page.

4303 Is Atomic Power Competitive? Cost factors are analyzed. ***W. L. Budge.*** *Journal of Metals*, v. 11, Jan. 1959, p. 36-37.

4304* Scheduling the Use of Water Power. A particular type of inventory model, a hydroelectric model, with a linear cost structure. The form of the optimal water utilization policy for a hydroelectric installation. The nature of the optimal policy if the cost function is convex. The optimal policy if future river flow is known. ***John Gessford.*** *Management Science*, v. 5, no. 2, Jan. 1959, p. 179-191.

4305* The Overhaul of a Back-Pressure Turbine. Details of procedure, recording of certain dimensions, suggestions for getting the most information out of the trial run. ***William Lamb.*** *Mechanical World and Engineering Record*, v. 139, Jan. 1959, p. 15-16.

4306 Nuclear Rocket Propulsion. Presents features of heat transfer, structural analysis, fluid flow, thermodynamics, ballistic flight, reactor physics, and radiation safety which are of particular pertinence. ***R. W. Bussard and R. D. DeLauer.*** 370 pp. 1958. McGraw-Hill, New York. (TL782 B96n).

4307* Power for Popular Private Cars. Capabilities of the Perkins Four 99 engine. *Oil Engine and Gas Turbine*, v. 26, Jan. 1959, p. 328-330.

4308* New Italian Small "Twin". B.C.M. 0.55-litre two-stroke developing 14.2 b.h.p. at 3,150 r.p.m. *Oil Engine and Gas Turbine*, v. 26, Jan. 1959, p. 349.

4309* An American Automotive Gas Turbine Plant. Brief details of the "702", Ford's turbine. *Oil Engine and Gas Turbine*, v. 26, Jan. 1959, p. 362.

4310* Gas Turbines for Oil Industry. Description of a few American built large gas turbine plants. ***Leo Walter.*** *Petroleum*, v. 22, Jan. 1959, p. 11-12.

4311* Torque-Speed is Your Motor Guide for Boiler-Feed Pumps. Role of check valves in applying motors to boiler-feed pumps. ***A. E. Beardmore.*** *Power*, v. 103, Jan. 1959, p. 64-65.

4312* How to Figure M-D Turbine Power. ***A. H. Sisson.*** *Power*, v. 103, Jan. 1959, p. 68-70.

4313* How to Plot M-D Turbine Performance. Curves representing the major ways of presenting performance of m-d turbines at design steam conditions. ***A. H. Sisson.*** *Power*, v. 103, Feb. 1959, p. 69-71.

4314* What's Ahead in Power Engineering. Review of the problem. *Power Engineering*, v. 63, Jan. 1959, p. 81 + 20 pages.

4315* UP Gets New 'Giant' Turbine. The road's fifth 8,500-hp gas turbine-electric locomotive. *Railway Age*, v. 146, Feb. 2, 1959, p. 23-25.

4316* Effect of Additives Upon the Ignition of Hydrocarbon—Air Mixtures Under Reduced Pressure. Efficiency of certain additives. (*In French.*) Influence d'additifs sur l'inflammation de mélanges hydrocarbure - air a pression réduite. ***M. Guinet.*** *Recherche Aéronautique*, 1958, no. 67, Nov.-Dec., p. 43-52.

4317 Rocket Propellants. Composition, manufacturing methods, and performance details of both solid- and liquid-propellants used in rockets, from small signal units to the largest missiles currently being launched. Includes propellant burning, ignition and igniters, and the various rockets that use each kind of fuel. Safety in the propellant manufacturing plant, and quality control of the product. Discusses the future of the present fuels, and reviews the theories that may lead to new ones, such as ion and photon propulsion, and anti-gravity. ***Francis A. Warren.*** 218 pp. 1958. Reinhold Publishing Corp., New York. (TL785 W25r)

4318* Notes on Air Breathing Engines for Supersonic Flight. Some aspects of supersonic engine design and the forms the air breather can take. Intake and exhaust arrangements. ***A. W. Morley.*** *Royal Aeronautical Society, Journal*, v. 63, Jan. 1959, p. 23-34.

4319* A Simple Reaction on Turbine as a Solar Engine. Design of a simple reaction turbine operating on saturated low pressure steam that could be generated by a solar boiler. ***S. T. Hsu and B. S. Leo.*** *Solar Energy*, v. 11, nos. 3-4, July-Oct. 1958, p. 7-11.

4320* Basic Optical Considerations in the Choice of a Design for a Solar Furnace. The optical possibilities afforded by two-mirror systems other than a paraboloidal mirror with heliostat are discussed and structural design for a two-mirror system presented. ***W. A. Baum and J. D. Strong.*** *Solar Energy*, v. 11, nos. 3-4, July-Oct. 1958, p. 37-45.

4321* Evolution of Aviation Engines. (*In French.*) L'Évolution des moteurs d'aviation. ***Jean Bertin.*** *Technique et Science Aéronautiques*, 1958, no. 4, Aug., p. 145-152.

4322* Problems of the Propulsion of Intercontinental Ballistic Missiles. A review. (*In French.*) Les problèmes posés par la propulsion d'un engin balistique intercontinental. ***H. Verdier.*** *Technique et Science Aéronautiques*, 1958, no. 4, Aug., p. 165-172.

4323* An Investigation Into Dynamics of Automatic Temperature Control System for Superheated Steam of a High-Pressure Drum-Type Steam Generating Unit. The results for superheated steam in a boiler with a surface steam cooler. (*In Russian.*) Issledovanie dinamiki sistemy avtomaticheskogo regulirovaniia temperatury peregretogo para barabannogo kotloagregata vysokogo davleniia. ***M. A. Duel'.*** *Teploenergetika*, v. 5, no. 12, Dec. 1958, p. 31-36.

4324* Change in the Radial Airgaps of Steam Turbine at Starting Up and in Operation. The experimental results concerning the change in airgaps during assembly, start-up, and in operation are given for three turbines tested. (*In Russian.*) Izmenenie radial'nykh zazorov v parovykh turbinakh pri puske i ekspluatatsii. ***M. A. Troubilov, E. I. Borevsky, and S. A. Prokhorov.*** *Teploenergetika*, v. 5, no. 12, Dec. 1958, p. 48-55.

4325* Improving the Performance of the Steam Power Plant by Means of the Gas Turbine. Various possibilities are provided through the combination of a steam turbine plant with a gas turbine, to utilize the heat in the steam circuit of gas turbine exhaust gases. The most advantageous arrangement would appear to be where the total gas turbine exhaust gases are conducted to the steam generator, without additional fresh air as combustion air. (*In German.*) Leistungssteigerung beim Dampfkraftwerk mittels der Gasturbine. ***Nebojša Gašparović.*** *VDI Zeitschrift*, v. 101, no. 1, Jan. 1, 1959, p. 9-13.

See also: **3866** (engine lube oil filtration); **4019** (thermochemistry of composite propellants).

INFORMATION—PREPARATION AND DISSEMINATION

4326* How to Write an Engineering Report. ***Jack W. Pearson.*** *Industrial Science and Engineering*, v. 6, no. 1, Jan. 1959, p. 16-18.

4327* Iron and Steel Dictionary. German-English. English-German. A small-size well-bound book designed to help specialists in both languages. Contains conversion factors and tables. 265 pp. 1958. Verlag Stahleisen, Düsseldorf, Germany. (TN609 St14)

4328* The Best Is None Too Good. Referring to advanced technical education, the issues of quality of students, quality of faculty, quality of leadership, and quality of teaching and research facilities are discussed. ***Lee A. DuBridge.*** *Journal of Engineering Education*, v. 49, no. 4, Jan. 1959, p. 299-307.

4329* Library Resources—The Professional Responsibility. Explores activities and objectives in collection and organization of world literature and possibility of national or international cooperation. ***Verner W. Clapp.*** *Library Resources and Technical Services*, v. 3, no. 1, Winter, 1959, p. 3-11.

4330* Future of Library Administration. Suggests that the most significant trends in library administration are volume growth, altered demands for library service, increasing competition for funds, increasing attention to basic research, and changes in education for librarianship. ***Eugene H. Wilson.*** *Library Trends*, v. 7, Jan. 1959, p. 472-480.

4331 Mechanical Resolution of Linguistic Problems. An account of some of the results which have been obtained at Birkbeck College Computational Laboratory on the application of digital calculators to linguistic problems. Records details of translating techniques achieved with the APEXC computer. ***Andrew D. Booth, L. Brandwood, and J. P. Cleave.*** 306 pp. Academic Press, New York. (PN242 B64m)

4332 Knee-Deep in Paper. Relates author's experiences in a seven-week tour of documentation centers in Europe. ***Allen Kent.*** *Product Engineering*, v. 30, no. 2, Jan. 12, 1959, p. 34-37.

4333* Preparation of Unsolicited Technical Proposals. ***Eric J. Young.*** *STWE Review*, v. 6, no. 1, Jan. 1959, p. 14-16.

4334 Engineering Information—All Is Not Lost. Efficient use of technical literature. Activities of the Engineering Societies Library and Engineering Index, Inc. ***Ralph H. Phelps.*** *Science*, v. 129, Jan. 2, 1959, p. 25-27.

4335* The Listing of Scientific Literature in Soviet National Bibliographies. Objective is to familiarize the science librarian with the material on all aspects of scientific endeavor that is listed in the national bibliographies of the Soviet Union. Describes the listing and arrangement of scientific material in these bibliographies as they appeared at the beginning of 1958. ***Karol Maichel.*** *Special Libraries*, v. 50, no. 1, Jan. 1959, p. 13-15.

4336 Normal Search Time: 45 Seconds. Maintaining a half-million medical records folders is speeded through new equipment. ***R. B. Benson.*** *Systems*, v. 22, no. 6, Nov.-Dec. 1958, p. 17-18.

4337 Tools for Machine Literature Searching. Present status of a research program for formulating methods to apply existing—or anticipated—developments in electronics to providing ready access to information stored in extensive collections of documents. It was found necessary to reformulate methods and procedures for analyzing, abstracting, and indexing scientific and technical papers. Includes a tabulation of words and terms with their codes in "machine language" and also the reverse tabulation, to permit finding the meaning of a code. ***J. W. Perry and Allen Kent.*** 972 pp. 1958. Interscience Publishers, New York. (Z695.9 P42t)

4338 Sodium and Bismuth Liquid Metal Fuel Systems; A Literature Search to June 30, 1957. Literature on Na, NaK, and Bi liquid metal reactor fuel systems is reviewed. ***Richard C. Vogel and Walton A. Rodger.*** *U. S. Atomic Energy Commission, ANL*-5933, Nov. 1958, 54 pp. (UF767 Un3.1an Contin.)

See also: **4139** (market research data sources); **4143** (voids in cost engineering data); **4279** (Kalfax microfilm).

INSTRUMENTATION

4339 American Vacuum Society, Inc., Fourth National Symposium on Vacuum Technology Transactions, 1957. Includes papers on fundamental developments in vacuum technology and engineering, new methods and techniques for obtaining high vacuum, instrumentation, controls and other vacuum devices, and industrial applications. ***Wilfrid G. Matheson, editor.*** 176 pp. 1957. Pergamon Press, New York. (QC166 C73v Over.)

4340* Comparative Tests on Some Instruments Used in Absorptiometric Methods of Analysis. Applications of the Hilger Uvispek spectrophotometer, the EEL absorptiometer, and the Hilger Spekker absorptiometer to the routine analysis of cast irons are examined. ***W. E. Clarke.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 9, Dec. 1958, p. 360-391 + 4 plates.

4341 Fine Particle Measurement. Size, Surface, and Pore Volume. Describes microscopy, sieving, sedimentation, radiation scattering and transmission, and inertial methods of size analysis. Surface area techniques include permeametry, gas adsorption, and liquid-phase sorption. ***Clyde Orr, Jr. and J. M. DallaValle.*** 353 pp. 1959. The Macmillan Company, New York. (TA407 Or7f)

4342 A Thermometer for High-Speed Aircraft. The principles of aircraft thermometer design are reviewed and the construction of the thermometer is described and the results of wind-tunnel tests are quoted and discussed. An outstanding feature of this thermometer is the remarkable constancy of the recovery factor over a range of Mach numbers from 0.2 to 0.9 and its rapid response to temperature changes, the lag coefficient being of the order of 2s. ***D. D. Clark.*** *Journal of Scientific Instruments*, v. 35, Dec. 1958, p. 433-439.

4343 A Precision, Direct-Reading, Colour Temperature Meter. The measuring element in the instrument described is a photomultiplier tube which views, alternately through red and blue filters, a diffuser illuminated by the lamp which is being calibrated. Readings can be made with an accuracy of approximately ± 5 K over the color temperature range from 2200 to 3200 K. ***P. Hariharan and M. S. Bhalla.*** *Journal of Scientific Instruments*, v. 35, Dec. 1958, p. 449-452.

4344 A Very Sensitive Relay, Able to Withstand Heavy Overloading. A galvanometer relay is described whose power amplification, i.e., the ratio between minimum input energy necessary to actuate the relay and maximum output energy available at the contacts of the polarized relay, is, in the simple prototype, $1:10^{12}$. Large input overloading is allowable, e.g., a current 100,000 times greater than the minimum failed to damage the instrument. ***F. H. Plankeel.*** *Journal of Scientific Instruments*, v. 35, Dec. 1958, p. 463-466.

4345 Image Intensifier for the Electron Microscope. An image intensifier is described in which a thin layer of selenium is placed in the electron microscope. The device is extremely sensitive and useful images can be obtained with electron microscope beam current densities of the order of 10^{-11} A/cm^2. ***M. E. Haine, A. E. Ennos, and P. A. Einstein.*** *Journal of Scientific Instruments*, v. 35, Dec. 1958, p. 466-467.

4346 Continuous Air Monitor for H^3. Using the flow-type ionization chamber, this monitor avoids the complexity and bulk of the particle counter but by means of a filter and ion-sweeper system, it is unresponsive to airborne sources of ionization other than radioactive gases. ***J. Brinkerhoff, C. A. Ziegler, R. Bersin, and D. J. Chleck.*** *Nucleonics*, v. 17, Feb. 1959, p. 76 + 2 pages.

4347* Sensitivity of Leak Detectors With a Helium Mass Spectrometer. Jointing out the first results obtained with standard leaks one thousand times lower than the presently available ones; the detected corresponding signal is much larger than could be expected from the usually assumed linearity between the detected signal and the helium flow introduced into the apparatus. Therefore, the generally assumed absolute sensitivity of detection by mass spectrometry would be increased as the leak tends to zero. (*In French.*) De la sensibilité de détecteurs de fuite par spectrométrie de masse à hélium. ***S. Choumoff.*** *Vide*, v. 13, no. 76, July-Aug., 1958, p. 193-196.

LUBRICATION AND FRICTION

4348* Chemical Nature of Extreme Pressure Lubrication. Engine performance can be improved and seizing can be prevented by incorporating an organo-metallic complex in the lubricating oil. The complex is selected from materials which decompose at high temperatures and produce a solid mineral deposit. Various materials may be combined to produce lubricants capable of improved performance. ***George Hugel.*** *Lubrication Engineering*, v. 14, Dec. 1958, p. 523-526.

4349 Choosing Lubricants for Heat and Cold. Primary factors for consideration in selection of lubricating oils for machinery operating in temperature ranges between −65 F up to 800 F. Synthetics such as di-esters are used in lubricants between −65 F and 130 F to prevent freezing and lubricant failure. At operating temperatures over 350 F, solid additives such as colloidal graphite or MoS_2 are used in suspension. Above 600 F the safest choice is colloidal graphite. ***Alden Crankshaw.*** *Machine Design*, v. 31, Feb. 5, 1959, p. 101-103.

4350 Testing Anti-Friction Bearing Greases. Grease of the correct quality is a very satisfactory substitute for oil; it can be extremely economical in use, one filling serving for months or even years and the application can usually be manged with systems far less complicated than those required for a fluid. ***E. G. Ellis.*** *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 14 + 3 pages.

4351 Some Practical Notes on the Lubrication of Anti-Friction Bearings. Design points for grease, high-temperature oil, and mist lubrication. *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 23 + 7 pages.

4352 The Lubrication of Antifriction Bearings in a Nuclear Power Station. In equipment which is peculiar to a nuclear power station where a reactor takes the place of a furnace as the heat source the conditions peculiar to the reactor have to be considered, the main ones being the presence of radiation, high ambient temperature, compatibility with the coolant gas and other materials present, and the risk of lubricant being carried inside the reactor. ***A. J. Marles.*** *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 33-37.

4353 The Sealing of Anti-Friction Bearings. Technological aspects of anti-friction bearings; review of current practice; classification of sealing methods; influence of working conditions and other factors; present-day tendencies; designing for synthetic rubber seals. ***E. T. Jagger.*** *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 39 + 6 pages.

4354 Some Notes on the Application of Molybdenum Disulphide to Anti-Friction Bearings. The rapid advance of $MoSi_2$ as one of industry's outstanding solid lubricants. ***H. Peter Jost and K. S. Paul.*** *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 48 + 4 pages.

4355 Centralised Lubrication and the Anti-Friction Bearing. While it is vitally important to select the correct lubricant for any given application, there is an equal necessity to ensure that it is introduced into the bearings in a clean condition, in the correct quantity, and at the prescribed intervals. ***N. R. W. Morris.*** *Scientific Lubrication* (Special Extra Issue), Nov. 1958, p. 55 + 2 pages.

4356* The Coefficient of Friction of Metals. The increase in the area of contact, and hence the adhesion, of a steel ball sliding on indium is explained. In the load range 0-100 g. the coefficient of friction of a ¼" steel ball sliding on indium is strongly dependent on the load, the coefficient of friction reaching very high values at light loads. ***C. Rubenstein.*** *Wear*, v. 2, no. 2, Nov. 1958, p. 85-96.

4357* Friction and Wear Properties of Titanium. Lubricants, with the possible exception of fluorocarbons, are ineffective in reducing the galling of bare Ti metal. Many of the wear problems have been minimized by coating the surface of the metal and then lubricating this surface. The wear resistance of the metal can be improved by oxide, nitride, and carbide case hardening and coatings. Chemical conversion coatings such as fluoride, phosphate, and anodized coatings help retain the lubricant and improve the resistance to galling. The most satisfactory procedure for preparing Ti surfaces for severe service is by the application of metallic coatings. Of the coatings tested, Ni has given the best results to date. ***P. D. Miller and J. W. Holladay.*** *Wear*, v. 2, no. 2, Nov. 1958, p. 133-140.

See also: **4364** (bearing loads).

MECHANICAL ENGINEERING

4358 Interference Fits. Presents a relatively quick method for solving design equations. ***D. A. Thurgood.*** *Aircraft Engineering*, v. 31, Jan. 1959, p. 6-7.

4359* Shear, Diagonal Tension, and Anchorage in Beams. Problems relating to shearing strength and diagonal tensile strength of reinforced concrete beams are discussed. Bending stresses will have an influence on both the direction of tension cracks and on the shearing strength of beams. ***E. M. Rensaa.*** *American Concrete Institute, Journal*, v. 30, no. 6, pt. 1, Dec. 1958; *ACI Proceedings*, v. 55, 1958, p. 695-715.

4360* Strains in Beams Having Diagonal Cracks. Reinforced concrete beams were tested to determine the validity of the usual assumptions that longitudinal reinforcement does not transfer vertical shear across a diagonal tension crack and that the maximum compressive strain within the shear span is developed at the extreme fiber. ***D. Watstein and R. G. Mathey.*** *American Concrete Institute, Journal*, v. 30, no. 6, pt. 1, Dec. 1958; *ACI Proceedings*, v. 55, 1958, p. 717-728.

4361* Influence Lines for Pressure Distribution Under a Finite Beam on Elastic Foundation. Indicates that influence lines for a parameter of 0.0001 may be used for infinitely stiff footings. Method is very handy and is specially useful in working out dynamic load effects. ***K. C. Ray.*** *American Concrete Institute, Journal*, v. 30, no. 6, pt. 1, Dec. 1958; *ACI Proceedings*, v. 55, 1958, p. 729-740.

4362* Computers for the Highway Engineering Program. Electronic computers are capable of relieving engineers of tedious computations and nonengineering responsibilities which are very time-consuming and costly. Standard routines can be set up for solution of problems in design of bridges and other structures, and subprograms written for different sequences of arithmetic operations. Programming would then constitute only the linkage statements which call for these subprograms. These linkage statements constitute a "compiler" language in which all programs could be written easily, rapidly, and accurately. ***Jack Belzer.*** *Computers and Automation*, v. 8, Jan. 1959, p. 12-13.

4363* Electromagnetic Conduction Pumps for Liquid Metals. Derives the fundamental equations for a D.C. electromagnetic pump. Then he describes the influences of the "reaction of the armature" upon the static and the dynamic pressure of the pump and gives methods for the elimination of these unfavorable influences. The design of a two-stage A.C. conduction pump is described which permits varying the flow of the pumped metal. (*In Czech.*) Elektromagnetická kondukční čerpadla na tekuté kovy. ***Zdneněk Ledr.*** *Elektrotechnický Obzor*, v. 47, no. 12, Dec. 1958, p. 608-613.

4364 Support-Spring Analogy Simplifies Solution of Indeterminate Shaft and Bearing Loads. Simplified approach to deflection and load calculations for continuous shaft carried by three or more bearings. ***M. F. Spotts.*** *Machine Design*, v. 31, Jan. 8, 1959, p. 133-136.

4365 Helical and Bevel Gears. Equations and tables for rapidly finding approximate gear dimensions from either wear or bending limits. ***Donald J. Myatt.*** *Machine Design*, v. 31, Jan. 8, 1959, p. 137-140.

4366 Thermal Stresses in Design. VII. Exact and Approximate Solutions. Advanced techniques in determining the thermal stresses in a body. Equations for classic body shapes. Methods involving complex variables. Beam theory. Beams with various temperature variations. ***S. S. Manson.*** *Machine Design*, v. 31, Feb. 5, 1959, p. 114-121.

4367 Methods for Plotting and Calculating Disc-Cam Curvature. Presents graphical and analytical techniques of curvature determination for reciprocating or oscillating, roller or flat-faced followers. ***J. Hirschhorn.*** *Machine Design*, v. 31, Feb. 5, 1959, p. 125-129.

4368* What the Designer Should Know About Production. IV. Hot-Forging. *R. B. Boswell.* *Machinery*, v. 65, no. 5, Jan. 1959, p. 132-139.

4369 New Manufacturing Techniques for Hydraulic Servo Valves. Method is described for obtaining the required accuracy of relationship between the sleeve ports and spool lands for a highly sensitive servo valve. ***Edgar M. Hakanson.*** *Machinery (London)*, v. 93, Dec. 24, 1958, p. 1464-1466.

4370 Designing With Brittle Materials. In designing with materials like ceramics, the problem of brittle failure must be taken into consideration. This factor can be minimized by increasing operating temperatures, applying loads slowly, increasing the ratio of shear-to-tensile stress, preventing stress concentrations, and replacing large members by several small ones. The designer should work closely with suppliers to obtain maximum desirable properties of materials. ***Winston H. Duckworth.*** *Materials in Design Engineering*, v. 49, Jan. 1959, p. 82-85.

4371 Product Design for −300 F. Typical applications and problems. ***P. E. Loveday.*** *Product Engineering*, v. 30, no. 5, Feb. 2, 1959, p. 60-62.

4372* The Complete Stress-Strain Law in Infinitesimal Elasticity. Shows that in infinitesimal strain, second order effects will be present when there is a rotation of the principal axes. ***M. Reiner and L. Rintel.*** *Research Council of Israel, Bulletin*, v. 6C, no. 2, Feb. 1958, p. 113-126.

4373* Some Remarks Concerning the Development of Transonic Axial-Flow Compressors. Describes qualitatively the transonic behavior of a two-dimensional compressor airfoil cascade. Some approximations are given on three-dimensional effects in an actual compressor blading. (*In French.*) Quelques remarques sur le développement des compresseurs axiaux transoniques. ***Pierre Schwaar.*** *Technique et Science Aéronautiques*, 1958, no. 3, June, p. 123-127.

4374 Vibration Control. Presents some of the fundamentals of vibration control which are a vital part of the background knowledge of the modern-day designer of engineering systems. Objectives are to provide basic theory and application in this area and to point out limitations of the elementary theory. ***John N. Macduff and John R. Curreri.*** 465 pp. 1958. McGraw-Hill, New York. (TJ173 M14v).

See also: **4792** (machine noise reduction).

METALLURGY

4375* Molybdenum and Tungsten Alloys. Recent progress in fabrication and properties. Molybdenum may one day cease to be an example of powder metallurgy since it is now being melted and cast. Tungsten alloys and hard metals will probably continue to be fabricated by powder metallurgy. Reviews preparation, properties, and applications of Co-cemented WC. ***E. J. Sandford.*** *Alloy Metals Review*, v. 9, no. 90, Dec. 1958, p. 2-8.

4376 Navy, USAF Spur High Heat Metals Tests. Some of the noteworthy developments that have taken place recently in the field of high temperature materials. ***Michael Yaffee.*** *Aviation Week*, v. 70, Feb. 2, 1959, p. 50 + 7 pages.

4377 Department of Defense Titanium Sheet-Rolling Program. Uniform Testing Procedures for Sheet Materials. *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 46D, Sept. 12, 1958, 34 pp. (TN799.T5 B32.7t Vis.)

4378* Ultra High Strength Steels. For this paper, those high cleanliness aircraft steels, stainless or otherwise, which possess ultimate tensile strengths varying from 200,000 to 300,000 psi, have widely differing load carrying ability over the temperature range −85 to 1,000 F. ***W. B. F. Mackay.*** *Canadian Aeronautical Journal*, v. 5, no. 1, Jan. 1959, p. 3-12.

4379 High-Temperature Alloys. Composition, applications and properties of heat-resisting and super alloys. Also describes the Cobalt Information Center, the history of cobalt, and world production statistics. Recent cobalt papers reviewed. ***Michel Urbain.*** *Cobalt*, no. 1, Dec. 1958, p. 13-31.

4380 New High Temperature Titanium Alloy—MST-881 Holds Properties to 1100°F. The new alloy, which exhibits strength properties excelling most steels for long periods, at temperatures of 1100 F and for short times to 1500 F was developed by Mallory-Sharon. *Light Metal Age*, v. 16, Dec. 1958, p. 21.

4381* **Titanium Drawing Is Both Cold and Hot.** Description of drawing operation in manufacture of a high-strength titanium casing for a small turbine. ***R. A. Lanciano.*** *Machinery*, v. 65, no. 5, Jan. 1959, p. 120-121.

4382 How to Select a Stainless Steel. Choosing the correct grade for a specific application is a matter of choosing the best possible combination of: corrosion or heat resistance, mechanical and physical properties, ease of fabrication, availability, and price. These and other characteristics are listed for a wide range of stainless steels. ***John L. Everhart.*** *Materials in Design Engineering*, v. 49, Jan. 1959, p. 95-110.

4383 Titanium Alloy Development. The following alloys were investigated: 6 Al-3 Mo-2 or 4 Be, 6 Al-3 Mo-4 Sn or Zr, 6 Al-3 Mo-2 Sn-2 Zr, 6 Al-2 Mo-1 Cr or 1 Mn or 1 V, and 6 Al-1 Mo-1 Mn-1 Cr or 1 V. *Metal Industry*, v. 93, Dec. 19, 1958, p. 512 + 1 page.

4384 The Tin Markets. The outlook for the tin market so far has undergone little change. *Metal Industry*, v. 94, Jan. 9, 1959, p. 21.

4385 The Metal Thorium. Proceedings of the Conference on Thorium held Oct. 11, 1956 at Cleveland, Ohio, under the joint sponsorship of U. S. Atomic Energy Commission and American Society for Metals. Subjects covered include usage of thorium in nuclear and non-nuclear applications, thorium in magnesium technology, thorium compounds, preparation of thorium oxide and iodide thorium, consumable arc melting, electrolytic refining, physical constants, mechanical properties, electronic structure, preferred orientation, recrystallization, corrosion, metallography, effects of irradiation, hazards, constitution and chemical and spectrographic analysis. ***Harley A. Wilhelm, editor.*** 397 pp. 1958. American Society for Metals, Cleveland. (TN799.T4 M56)

4386 The Development of Beryllium for Nuclear Reactor Applications. The production of ingot and powder metal, fabrication, and mechanical properties. The possibility of improving the ductility is considered. ***G. C. Ellis.*** *Metallurgia*, v. 58, Dec. 1958, p. 265-269.

4387 Alloy Stands Up to Heat. New Cr-Mn-Ni steel retains much of its room temperature strength at elevated temperatures. It is fully austenitic and nonmagnetic. *Steel*, v. 144, Jan. 12, 1959, p. 84-85.

4388 Manufacturing Bearing Linings of Lead Bronze by Powder Metallurgy Technology. Two proven methods of manufacturing lead bronze bearing linings by powder metallurgical techniques. (*In Czech.*) Sdružená ložiska s výstelkou z olověného bronzu, vyráběná způsoby práškové metalurgie. ***Z. Ministr, E. Navara, and V. Procházka.*** *Strojírenství*, v. 8, no. 11, Nov. 1958, p. 857-859.

4389 Uses of Radioactive Isotopes in Metallurgy, Symposium XXXIV. I-II. Use of radioactive tracer elements in studies of diffusion, chemical reaction, homogeneity, quality, and composition analysis. *U. S. Atomic Energy Commission, AEC-tr-*3100 (Pts. 1-2), 1955, 270 and 56 pp. (Translated from a publication of the State Scientific-Technical Publishers of Literature on Non-Ferrous and Ferrous Metallurgy, Moscow, 1955). (UF767 Un3.1ac Contin.)

4390 Sources of High-Purity Elements. A catalog of suppliers of high purity elements. ***O. E. Snyder, R. E. Reichhold, E. M. Spenger, and G. J. Lundquist.*** *U. S. Atomic Energy Commission, UCRL-*5368, Oct. 1958, 42 pp. (UF767 U3u Contin.)

See also: **4327** (iron and steel dictionary).

METALS—CORROSION

4391 Causes and Prevention of Corrosion in Aircraft. Corrosion in manufacturing, storage and service of engines, associated components, and electrical equipment. Protective coating processes discussed include: electroplating, anodic oxidation, chromating, metallizing, and organic paints. Non-destructive examination is discussed. ***T. C. E. Tringham.*** 124 pp. 1958. Sir Isaac Pitman & Sons, Ltd. London. (TL699.M4 T73c)

4392 Corrosion Problems With Pressure Vessels. With the application of fired and unfired pressure vessels increasing notably in such industries as the chemical, petroleum, food processing and paper, the problem of corrosion control increases. Causes of failure in pressure vessels have often been the result of corrosion or erosion of the metal. ***Henry Allen.*** *Corrosion Technology*, v. 5, Dec. 1958, p. 390 + 1 page.

4393 Measuring the Attack of Gases on Solid Surfaces. Procedure employs time-lapse photography of the reacting solid so that a permanent record of the reaction's progress is obtained. *Corrosion Technology*, v. 6, Jan. 1959, p. 9.

4394 The Flade Potential of Iron Passivated by Various Inorganic Corrosion Inhibitors. The characteristic potential obtained just before decay of passivity (Flade potential) was measured for iron passivated by ferrates, nitrites, chromates, molybdates, tungstates, conc. HNO_3, and by anodic polarization in H_2SO_4. ***Herbert H. Uhlig and Peter F. King.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 1-7.

4395 Some Observations on the Mechanism of Inhibition. Thiocyanic and citric acids are efficient inhibitors of dissolution of iron in dilute HNO_3 solutions. Inhibition does not generally involve "poisoning" the combination step in the hydrogen evolution reaction. Some observations on the kinetics of dissolution of iron in dilute HNO_3 solutions are also presented. ***A. C. Makrides.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 7-9.

4396 Oxidation of Titanium, Zirconium, and Hafnium. Alterations in the rate equations relating to such processes may be associated with the establishment of oxygen diffusion gradients in the surface layers of the metal. These diffusion gradients in the metal extend in depth during an initial period in which the total rate of oxidation is given by the familiar parabolic equation. Subsequent changes in oxidation behavior have been related to observed alterations in the form of these gradients. ***G. R. Wallwork and A. E. Jenkins.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 10-14.

4397 The Electrical Resistance of Oxide Films on Zirconium in Relation to Corrosion. The conductivity of anodic and corrosion films on zirconium was found to increase during heating in vacuum. The conductivity changes at 450 C were studied on anodic films which were 0.6, 0.75, 0.9, and 1.5 μ in thickness. ***R. D. Misch and F. H. Gunzel, Jr.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 15-20.

4398* **The Influence of Stabilizing With Columbium or the Resistance of 18% Cr and 9% Ni Stainless Steel Against Intercrystalline Corrosion.** The authors studied on 18/9/Nb steels the correlation between the abnormal heat treatment at very high temperatures and their intercrystalline corrosion following heating in the range of temperatures between 550 and 850 C. They ascertained that the main reason for intercrystalline corrosion would be the solution of columbium carbides and following precipitation of $(Cr, Fe)_{23}C_6$ chromium carbides at grain boundaries. Compared with the solubility of titanium carbides in with titanium stabilized steels, the solubility of columbium carbide in 18/9/Nb steels is little lower. At considerably higher than stoichiometric columbium content with respect to carbon content the solubility of columbium carbide diminishes similarly to titanium steels but the quantity of δ ferrite grows more than on increasing titanium content. At temperatures beneath 800 C dangerous embrittlement in consequence of σ-phase formation occurs in steels with high columbium content. The unfavorable influence of high homogenizing temperature on the intercrystalline corrosion of 18/9/Nb steels can be eliminated on annealing at temperatures of 850 up to 950 C. (*In Czech.*) Vliv stabilisace niobem na odolnost antikorosní oceli s 18% Cr a 9% Ni proti mezikrystalové korosi. ***Vladimír Číhal and Rudolf Pospíšil.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1092-1098.

4399* **A Radioactive Corrosion Probe.** Internally cooled steel probes are in general use for the estimation of corrosion rates of cooled surfaces exposed to flue gases. By using a radioactivated probe the metal lost during a test may be

estimated by a count of the radioactivity of the probe washings. It may be possible to develop a probe on this principle to give a continuous indication of corrosivity. The author describes the design and performance of a simple prototype probe which demonstrated that accurate results should be possible using probe exposure times as short as 10 minutes, and counting times of 2 minutes with conventional counting equipment. With the design described, health hazards due to radioactivity are very slight provided that elementary precautions are taken to avoid direct handling of radioactive parts. ***D. Anson.*** *Institute of Fuel, Journal*, v. 32, Jan. 1959, p. 10-14 + 1 plate.

4400 Corrosion at Metal-to-Plastics Joints. In the instance reviewed here, in which corrosion products appeared at the junction of a metal saucepan and its plastic handle, the immediate source of the trouble was the contiguity of unsuitable materials. *Metal Industry*, v. 94, Jan. 9, 1959, p. 32.

4401 Oxidation Resistance of Niobium Alloys. *Metal Industry*, v. 94, Jan. 16, 1959, p. 47-48.

4402 The Corrosion of Thorium and Its Alloys. Discussion is primarily concerned with the behavior of the metal thorium and its alloys in contact with environments encountered in the several types of power reactors. The corrosion problems attendant upon the use of thorium oxide as a fuel are discussed briefly. ***W. E. Berry, R. S. Peoples, and H. A. Pray.*** Paper from "The Metal Thorium", p. 267-276, 1958. American Society for Metals, Cleveland. (TN799.T4 M56)

4403* Grain Boundary Oxidation of CrNiW Steel. In the automatic steel studied, cracking was due to the formation of the heterogeneous intercrystalline phase or to a significant decrease of fatigue strength in the steel. Coating with electrolytically deposited Cu before hardening. Annealing; no carburization or oxidation; satisfactory application in service. (*In German.*) Korngrenzenoxydation von CrNiW-Stählen. ***P. Csokán.*** *Metalloberfläche*, v. 12, Aug. 1958, p. 230-232.

4404* The Interferometric Measurement of Metal Oxide Films. An interferometric method is described for investigating oxide films *in situ* on the metal surface. The method yields the surface finish of the inside and outside surfaces of a metal oxide film, its volume ratio, its thickness and the location of the original surface with respect to the two oxide surfaces. All this information is contained in a single photograph provided the refractive index of the oxide is known. Some results for anodic oxide films on aluminium are given. ***J. C. Kelly.*** *Optica Acta*, v. 5, nos. 3-4, Sept.-Dec. 1958, p. 75-78.

4405 On the Mechanism of Anodic Oxidation of Tantalum. It is shown that the transport of Ta ions is neither governed by a pure vacancy mechanism, nor by a pure interstitial process. ***B. Verkerk, P. Winkel, and D. C. de Groot.*** *Philips Research Reports*, v. 13, no. 6, Dec. 1958, p. 506-508.

4406* Growth and Structure of the Oxidation Films on Iron at Elevated Temperatures. High-temperature oxidation tests have been made on "monoface" specimens of iron of various purities containing "reserves" of refractory metals. Mechanical effects between the oxides and iron during growth and cooling lead to considerable deformations. To an extent governed by the geometry and the relative amounts of oxide and metal, the stresses set up during growth determine the fissuring and relaxation. Further, a distinction is made between genuine porosity and mechanical fissuring of the oxide. (*In French.*) Croissance et morphologie de pellicules d'oxydation du fer aux températures élevées. ***J. Moreau and M. Cagnet.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1091-1109.

4407 Investigation of Fe-Mn-Cr-N-C System for Heat Resistance and Oxidation Resistance Between 1200 F and 2000 F. Additions to this system included V, Nb, W, Mo, Ca, or Si. Some of the alloys had room and elevated temperature tensile properties and creep strength comparable to A 286 and Inco 901. Si addition increased oxidation resistance at 2000 to 2200 F to compare with Type 310 stainless steel. ***J. P. Tarwater and E. J. Dulis.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-242, pt. 2, Oct. 1958, 103 pp. (TL507 Un3.18w Vis.)

4408 Hydriding of Zirconium and Uranium in Organic Coolants. It is the purpose of this work to study the corrosion of uranium and zirconium in organic coolants in the presence of hydrogen and low water concentrations. ***V. H. Troutner.*** *U. S. Atomic Energy Commission, HW*-58146, Nov. 12, 1958, 19 pp. (UF767 Un3.1hw Contin.)

See also: **4039** (corrosion and the epoxides).

METALS—EXTRACTION AND REFINING

4409 Continuous Casting of Light-Section Steel Billets and Subsequent Cross Rolling Without Process Anneal. New production process for balls used in crushing or grinding mills, for example, for coal, based on use of continuous-cast hot billets gas cut into short lengths and then cross rolled, quenched and tempered. Flowsheet of entire ball-manufacturing process; routine production of balls: their hardness; steel composition, etc. Merits of proposed process: Huge economies over conventional process, such as elimination of semiproduct stage, elimination of heating for rolling; quenching and tempering; very high dimensional accuracy of balls; high productivity of process. ***A. S. Nikiforov.*** *Henry Brutcher Translation No.* 3951, 8 pp. (From *Proceedings of the First All-Union Conference on the Continuous Casting of Steel*, Oct. 1955, Moscow, 1956, p. 123-128.) Henry Brutcher, Altadena, Calif.

4410 Continuous Casting of Steel Into Square-Section Billets. Experience in pilot-scale continuous casting of 8 inch (200 mm) square billets of steel (carbon, tool, low alloy). Movement and lubrication of mold. Recommended casting speed for medium-carbon steel: time required for complete freezing of an 8-in. square billet; calculated depth of crater of liquid metal; best level for placing the first group of pinch rolls. Incorporation of lessons learned into design of new continuous casting plants, in part already building in the Soviet Union. ***V. S. Rutes and N. A. Nikolaev.*** *Henry Brutcher Translation No.* 4425, 9 pp. (From *Metallurg*, no. 10, Oct. 1958, p. 15-18.) Henry Brutcher, Altadena, Calif.

4411 A Method for the Purification of Selenium. A method has been worked out for purifying selenium based on the formation and decomposition of hydrogen selenide. Details of an apparatus capable of producing about 10 g/hr. of extremely high purity selenium are given. Several analytical methods used in examining the product are outlined. ***S. Nielsen and R. J. Heritage.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 39-43.

4412 Vacuum Pouring of Ingots for Heavy Forgings. Experimental use of a 7-ton capacity unit, coincident with the construction of a 250-ton production unit at the Bethlehem Steel Company enabled the development of practices and techniques for immediate application to the large unit on initial production. Ingots can be produced as large as 120 in. dia. and 500,000 lb. weight. The advantages of the process are obtained with considerable expense for equipment and operation. However, the improvement in quality of product more than justifies the added cost for critical applications of forgings. ***J. H. Stoll.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 67-80.

4413* Intensification of Steel Melting Processes as Affected by a Stream of an Oxidizer. Experimental evaluation of conditions of an efficient blast delivery into metal both from the viewpoint of: 1) utilization of oxidation possibilities of the blast, 2) regulation of the order and rates of oxidation of components contained in metallic melts. High frequency induction furnace used. (*In Russian.*) Intensifikatsiia staleplavil'nykh protsessov pri vozdeistvii strui okislitelia. ***V. V. Iakovlev, S. I. Filippov, P. P. Arsent'ev, and G. S. Surovtsev.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1958, no. 4, p. 17-22.

4414* Kinetics of Migration of Sulphur From Pig Iron Into Blast Furnace Slags. Establishing the limit of desulfurization process under condition of blast furnace. Investigation of CaO, SiO_2 and Al_2O_3 slag systems obtained by fusion of chemically pure components. All the investigated slags contained 10% of Al_2O_3, and the CaO:SiO_2 ratio was in the range from 0.9 to 1.3. (*In Russian.*) Kinetika perekhoda sery iz chuguna v shlaki domennogo tipa. ***V. A. Krivonosov and S. I. Sharov.***

Nauchnye Doklady Vysshei Shkoly, Metallurgiia, 1958, no. 4, p. 28-33.

4415* Processes of Re-Oxidation of Electric Furnace Steel. Investigation of formation of secondary oxide inclusions in steel melted in an electric furnace. Study of: 1) effect of chemical compositon on the steels tendency toward formation of oxide films in furnace, 2) secondary oxidation of steel streams during pouring, and 3) re-oxidation of steel in molds. Investigation of: 1) oxide films and slag, and 2) macrodefects in electric furnace steel in their relation to re-oxidation. (*In Russian.*) Protsessy povtornogo okisleniia v elektrostali. ***Iu. A. Shul'te.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1958, no. 4, p. 52-58.

4416* Study of the Behavior of Nitrogen When Purifying Calcium by Vacuum Sublimation. The main purpose of this study was to find out whether there existed any relationship between the condensation temperature and the amount of combined nitrogen contained in the recovered metal. (*In French.*) Contribution à l'étude du comportement de l'azote lors de la purification du calcium par sublimation sous vide. ***Claude Decroly and Claude Den Tandt.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1009-1022.

See also: **4534** (solidification of cast steel).

METALS—FINISHING, POLISHING, AND CLEANING

4417 Roller Burnishing of Heavy-Duty Parts Preparatory to Hard Chromium Plating. Advantages of roller burnishing of steel parts expected to show a high endurance strength and high resistance to corrosion fatigue aimed at neutralizing the harmful tensile stresses set up in plating. Service test results on various heavy-duty parts. ***G. P. Kotlyarevskii.*** *Henry Brutcher Translation No.* 4286, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 52-53.) Henry Brutcher, Altadena, Calif.

4418 The Nature of Mechanically Polished Metal Surfaces: An Electron-Diffraction Examination of Polished Silver Surfaces. Electron-diffraction patterns characteristic of crystalline material, obtained from surfaces of both polycrystalline and single-crystal silver polished mechanically by a standard metallographic method, show that the range of the misorientations—and hence the magnitude of the deformation at the surface—produced by polishing decreases progressively with increasing fineness of polish. With the finest polish investigated, the misorientations were only about ±5°. No evidence was found of a layer of peculiar structure of the type postulated by Beilby. ***L. E. Samuels and J. V. Sanders.*** *Institute of Metals, Journal*, v. 87, pt. 5, Jan. 1959, p. 129-135.

4419 Metal Smoothing. A radical heat-pressure process for boosting the wear resistance of machined-steel parts. This is another "first" for the Russians. *Machine Design*, v. 31, Feb. 5, 1959, p. 29 + 2 pages.

4420* Deburring by Machine Proves Economical. Description of a mechanical deburring operation. *Machinery*, v. 65, no. 5, Jan. 1959, p. 97.

4421 Metallurgy in Flat Polishing. ***Adam Zimmerman.*** *Plating*, v. 46, Jan. 1959, p. 34-35.

METALS—FOUNDRY PRACTICE

4422 Molten Metal Delivered to Ford Aluminum Foundry. *Automotive Industries*, v. 119, no. 11, Dec. 1, 1958, p. 30-31.

4423* The Effect of Heat on the Properties of Compacted Moulding Materials. Factors which determine the development of the hot-strength peak in molding-sand mixes and the bearing which this peak has upon the retained strengths on cooling have been investigated, using various sands and bonds. ***J. L. Evans and J. White.*** *British Foundryman*, v. 51, Dec. 1958, p. 615-625.

4424* Solidification and Risering of Grey-Iron Castings. Experimental data and theoretical analyses are used to delineate the fundamental variables for determining shrinkage in grey iron. ***Clyde M. Adams, Merton C. Flemings, and Howard F. Taylor.*** *British Foundryman*, v. 51, Dec. 1958, p. 625-636.

4425* From Gravity Die-Casting to Shell Moulding. Describes how a particular casting was produced by the shell molding process and gives some idea of the saving that can be achieved by producing very small castings by shell molding, provided that the quantities required are sufficiently high. ***D. Miller.*** *British Foundryman*, v. 52, Jan. 1959, p. 2-3.

4426* Foundry Clays. Deals with the three main types of clays; the kaolinites, illites, and montmorillonites. Methods of identification are described, with special reference to sample tests which can be conducted in the foundry and to the significance of the D.T.A. method of identification. The general properties of the clays in relation to foundry work are fully dealt with, together with their uses and applications. Includes discussions of papers. ***J. J. Marais.*** *British Foundryman*, v. 52, Jan. 1959, p. 4-9.

4427* Investment Casting—Recent Experiences and Improved Techniques. Vacuum casting and refractory shell-mold production are mentioned as the next phase in the improvement of the investment process. ***D. F. B. Tedds.*** *British Foundryman*, v. 52, Jan. 1959, p. 10-17.

4428 Repair of Large Bell [of a Blast Furnace]. Note on a time-saving technique employing hard facing for the repair of a damaged bell of a blast furnace operated at 15-17 psig top pressure and suffering from gas leaks. ***V. A. Karasik.*** *Henry Brutcher Translation No.* 4333, 4 pp. (From *Metallurg*, no. 5, May 1957, p. 8-9.) Henry Brutcher, Altadena, Calif.

4429 Sources of Contamination of Steel by Oxide Inclusions During Tapping and Pouring. Failure of recently improved deoxidizing practices to give a steel, specifically ball bearing steel, that is free from oxide inclusions. Author's study of effect of the formation of oxide inclusions in seven 1% C, 1.55 Cr steel heats, based on use of calcium-45, zirconium-95, and tantalum-182 as tracers. Investigational procedure; incorporation of tracers; sampling of steel; how to compare intensity of radiation from steel samples containing tracer both in solution and as inclusions, with intensity of radiation from nonmetallic inclusions isolated from steel by electrolysis. Change in radioactivity of ladle slag as criterion of secondary oxidation and burning out of deoxidizers. Oxygen content of steel determined by vacuum hot extraction. ***E. I. Malinovskii and A. N. Morozov.*** *Henry Brutcher Translation No.* 4400, 14 pp. (From *Izvestiya Akad. Nauk, Otd. Tekh. Nauk*, 1957, no. 8, Aug., p. 102-108.) Henry Brutcher, Altadena, Calif.

4430 Blast Furnace Performance Improved by Changing the Blast Composition. Effect of replacing part or all of the nitrogen in the blast passing through a blast furnace by active reducing agents, upon the rate of reduction, preliminary pilot plant experiments having shown that an increase in the amount of reducing agents by 35-70% almost trebles the rate of reduction. ***E. M. Lokshin and Yu. S. Borisov.*** *Henry Brutcher Translation No.* 4403, 19 pp. (From *Stal'*, v. 18, no. 5, 1958, p. 391-397.) Henry Brutcher, Altadena, Calif.

4431 Effect of Vacuum Melting Upon Steel Quality. Furnace pressures ranging from 760 down to 0.005 mm. Hg: effect on C, Mn, Si, Cr, P, S and especially oxygen and nitrogen contents. Tensile and impact properties in forged and heat-treated state as function of pressure during (re-) melting. ***Ya. M. Bokshitskii, A. V. Emyashev, A. M. Zubko, and M. M. Filippychev.*** *Henry Brutcher Translation No.* 4405, 17 pp. (From *Stal'*, v. 18, no. 6, 1958, p. 520-525.) Henry Brutcher, Altadena, Calif.

4432 Tungsten Zone Melting by Electron Bombardment. An apparatus for refining tungsten in vacuum by the floating zone method is described. Spectrographic analyses along the length of a purified tungsten rod indicate that molybdenum may not be removed by zone refining, but rather by volatilization. Further, X-ray diffraction studies show that tungsten rods

purified in this manner are single crystals and these crystals as grown from the melt do not exhibit preferential growth. ***R. G. Carlson.*** *Electrochemical Society, Journal,* v. 106, Jan. 1959, p. 49-52.

4433 Corrosion Product and Inhibitor Films on Aluminum. *H. W. McCune.* *Electrochemical Society, Journal,* v. 106, Jan. 1959, p. 63-65.

4434 The Flow of Steel in Molds. This series of six lectures brings together the findings of recent investigations which have been presented in many publications as a handy, single reference on the flow of steel in molds. It will also act as a guide to the younger men entering the industry so that they will have a background of fundamentals on which to build their gating experiences. It covers fluid flow, dynamics of flow of steel, fluidity of steel, and its behavior in the mold. ***Charles W. Briggs, Editor.*** 120 pp. 1958. Steel Founders' Society, Cleveland. (TS320 St32f.)

4435 The Flow of Steel in Runners and Gates. By means of an experimental mold design, the hydraulics of various gate-runner-sprue patterns were studied and an effective design was evolved from the data presented. Six essential points of design are enumerated for superior results. ***W. H. Johnson.*** Paper from "The Flow of Steel in Molds", p. 48-70. 1958. Steel Founders' Society, Cleveland. (TS320 St32f.)

4436* The Thermal Treatments of Meehanite Cast Iron. Classification of heat treatments. Characteristics of the thermal cycle. Stress reduction as function of temperature, of the duration of the operative temperature, of the chemical composition of the casting, and of the cooling rate. Different types of hardening applied to Meehanite cast iron. (*In Italian.*) Itrattamenti termici della ghisa meehanite. ***Alfredo Secciani.*** *Fonderia,* v. 7, Nov. 1958, p. 501 + 13 pages.

4437 Now They're Casting Photos. New process involves use of conventional photographic methods to make wax patterns for producing finely detailed castings by the investment casting technique. ***Robert H. Herrmann.*** *Foundry,* v. 87, Feb. 1959, p. 78-80.

4438 Economic Design of Light-Alloy Castings. Test-bar specifications for a number of aluminum and magnesium alloys are given, and are discussed in relation to strength and weight of castings, and also to certain features of design, and to the cost of a machined casting in cast iron and various light alloys. ***P. A. Broadbent.*** *Foundry Trade Journal,* v. 105, Dec. 18, 1958, p. 737-744.

4439* Melting Plain Carbon and Alloy Steels in the High Frequency Induction Crucible Furnace. Remelting and refining processes—furnace systems—advantages of the induction furnace in the steel foundry, melting alloy steels in the high frequency induction furnace, melting loss conditions, technology of alloy steels in the high frequency induction furnace, production of plain carbon steel castings, economic efficiency, trends of development of induction melting. (*In German.*) Das Erschmelzen von unlegierten und legierten Stählen im Netzfrequenz-induktionsofen. ***Dieter Hartmann.*** *Giesserei,* v. 46, no. 2, Jan. 15, 1959, p. 25-30.

4440* The Application of Copy Milling Machines in the Fabrication of Molds and Patterns. Applications, the pantograph, engraving and copy milling machine, mechanical fabrication of patterns, example taken from the practice. (*In German.*) Anwendung von Nachformfräsmaschinen im Formen- und Modellbau. ***Franz Rossberger.*** *Giesserei,* v. 46, no. 2, Jan. 15, 1959, p. 30-34.

4441* Investigation on the Economy of Using Exothermic Feeding Agents. Subject and practice of the investigation, results: methods of using exothermic agents; extent of the savings in exothermic feeders; examples of calculation with standard values derived therefrom; special treatment of the cost of exothermic agents within the cost account; miscellaneous savings and surplus cost when using exothermic agents. (*In German.*) Wirtschaftlichkeitsuntersuchung über die Anwendung von Heizmassen in Stahlgiessereien. ***Leo Remmeke.*** *Giesserei,* v. 46, no. 2, Jan. 15, 1959, p. 34-37.

4442* With Phosphorus Pentachloride Inoculated Hypereutectoid Al—Si Alloys. Influence of Temperature and Time on the Size of Silicon Primary Crystals. Following conclusions can be derived from tests performed for the technology of manufacture of hyper-eutectoid Al–Si alloys with about 20% Si content: (1) The most suitable inoculation temperature upon adding 0.45% phosphorus penta-chloride is in the range between 780 and 810 C. (2) The temperatures above 810 C have no appreciable influence on the size of primary crystals supposing that casting is performed immediately after the inoculation. (3) The influence of phosphorus pentachloride in the found range of temperatures (780 to 810 C) remains essentially unchanged with the time of maintaining the bath on temperature. (4) Just so the remelting has no influence on the refining effect of PCl_5 addition. The tests performed have shown that by means of suitable choice of temperature and time uniform and fine-grained separation of silicon primary crystals in a hypereutectoid alloy can be obtained. (*In Czech.*) Očkování nadeutektických slitin Al–Si chloridem fosforečným. Vliv teploty a doby na velikost primárních krystalu křemiku. ***Josef Koritta and A. Franěk.*** *Hutnické Listy,* v. 13, no. 12, Dec. 1958, p. 1081-1087.

4443 Twin-Strand Continuous Casting Installation. Much of the material cast so far has been carbon steel, with carbon contents ranging from 0·05 to 0·85%. For these steels, the average yield of commercially sound material is between 98 and 99%. Equally good yields have been obtained with low alloy steels, including silico-manganese spring steel and high sulphur free-cutting steel, and stainless steels. *Machinery (London),* v. 94, Jan. 14, 1959, p. 88.

4444 Design of Die-Castings. IX. Converting Sand-Cast Parts to Die-Casting. *H. K. Barton.* *Metal Industry,* v. 94, Jan. 9, 1959, p. 29-30.

4445 Die-Casting Alloy for Anodizing. The demand for color-anodized die-castings has so far come largely from the building industry. An aluminum-magnesium alloy, for which a patent has been granted, enables a consistent anodic finish to be obtained from a relatively inexpensive alloy. Basically, the alloy has between 1 and 3.5% magnesium, 0.5 to 1.5% manganese, and one or more of the alkaline earth metals, calcium, strontium, and barium, are added, together with a slight addition of beryllium. *Metal Industry,* v. 94, Jan. 9, 1959, p. 30-31.

4446* Foundries Can Produce Their Own Cast Iron Directly From Ore. Foundries might increase their profits by using some recently developed direct-reduction processes for producing their iron. Some of these processes are suitable for integration into a foundry to replace the conventional cupola facilities and other melting auxiliaries. Under some conditions which exist in iron foundries today, these processes can be used to produce and melt iron more cheaply than by the present conventional methods. The use of direct-reduction processes would also reduce the foundry's dependence on outside sources of pig iron, scrap, and coke. The background of direct-reduction processes is given. Typical processes are described, and their advantages and disadvantages are discussed. Costs of producing iron by direct-reduction are summarized, and are compared with those involved in melting in a cupola. ***H. W. Lownie, Jr. and A. J. Stone.*** *Modern Castings,* v. 34, Jan. 1959, p. 47-54.

4447* Porosity in Magnesium Alloys. A series of experiments with binary magnesium-aluminium alloys containing 0, 3, 6 and 10% Al. Study of porosity formation at higher or lower cooling rates, and of the mechanism of porosity formation. (*In Russian.*) Poristost' v magnievykh splavakh. ***M. V. Sharov and E. L. Bibikov.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia,* 1958, no. 4, p. 101-107.

4448* The Role of the Metallurgist in the Production and Usage of Austenitic Manganese Steel Castings. Points of importance relating to the manufacture, treatment, and metallurgy of manganese steel castings. The necessity for a good control on casting temperature is stressed. Emphasis is placed on the actual hardness figure of the cold worked surface rather than the lower hardness figure as given by the conventional Brinell machine using 3,000 Kg and a 10 mm. ball. The usefulness of ascribing an approximate sizing figure to the usually given "fine" "medium" and "coarse" grain is mentioned. ***B. Needleman.*** *South African Institute of Mining and Metallurgy, Journal,* v. 59, no. 5, Dec. 1958, p. 229-257.

4449* Laboratory Apparatus for the Melting and the Vacuum Casting of Pure Iron and of Iron Alloys. Owing to the simple method developed, 2 kilograms of 99.97% pure iron were prepared in one operation in the crucible with possibility to incorporate alloys elements in a determined quantity. (*In French.*) Appareillage de laboratoire pour la fusion et la coulée sous vide de fer pur et d'alliages de fer. ***M. Olette and A. Chaillou.*** *Vide*, v. 13, no. 76, July-Aug., 1958, p. 177-187.

METALS—HEAT TREATMENT

4450 Nitriding of High-Strength Magnesium-Treated Cast Iron. Study of rate of formation and nature of phases present in nitrided cases. Properties as function of nitriding temperature and nitriding time. Advantages of nitriding Mg-treated cast iron. ***Yu. M. Lakhtin and D. S. Pinchuk.*** *Henry Brutcher Translation No.* 4282, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 39-42.) Henry Brutcher, Altadena, Calif.

4451 Improved Heat Treating Practice for Cold Roll Sleeves Made of Steel 9KhF. Use of a new basic open-hearth steel containing 0.90% C, 0.65% Cr, and 0.22% V, and distinguished by a low tendency to crack, for the manufacture of sleeves for backing-up rolls in cold-rolling mills. Forging and heat treating practices involving two upsetting steps with intermediate process anneal for finer primary grain and better macrostructure; two-stage isothermal treating cycle for satisfactory hardness coupled with good machinability; and a quenching and tempering practice giving a good surface hardness of the sleeves and a minimum of residual stresses. ***I. E. Brainin, A. I. Kondrashov, and V. A. Kharchenko.*** *Henry Brutcher Translation No.* 4283, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 43-46.) Henry Brutcher, Altadena, Calif.

4452 Effect of Barium Acetate on Activity of Solid Carburizing Compounds. Effect of barium carboxylates on activity of carburizers. Promise of a high-activity carburizing process in which liquid acetone or its vapors are used. ***L. K. Luksha.*** *Henry Brutcher Translation No.* 4285, 4 pp. (From *Metallovedenie i Obrabotka Metallov*, July 1958, no. 7, p. 50-52.) Henry Brutcher, Altadena, Calif.

4453 Effect of Heat Treating on Notch Sensitivity of Chrome-Molybdenum-Vanadium Steel. Effect of heat treating on the notch sensitivity of two Cr-Mo-V steels during testing for rupture strength. Heat treatments recommended for reduced notch sensitivity and reduced embrittlement at 500 C. ***Z. N. Petropavlovskaya.*** *Henry Brutcher Translation No.* 4287, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 54-58.) Henry Brutcher, Altadena, Calif.

4454 Measurement of Carburizing Efficiency of Salt Baths. Results of studies of the efficiency of carburizing baths, conducted at the German Institute for Hardening Technology. Determination of carbon potential over a two-month period, at 900 C (1650 F) of an activated three-salt bath with constant potassium cyanide content. Conclusions drawn as to completeness of information on carburizing media when using both methods (for carbon potential and for carbon transfer rate) simultaneously. Extra requirement for measuring carbon potentials near the gamma saturation point. ***O. Schaaber and R. Fischer.*** *Henry Brutcher Translation No.* 4308, 26 pp. (From *Härterei-Techn. & Wärmebehandlung* (Supplement to *Industrie-Blatt*), v. 2, no. 10, 1956, p. 89-90 and 92-96.) Henry Brutcher, Altadena, Calif.

4455* Heating of Steel Billets Prior to Rolling. Improved quality obtained by heating with direct passage of current. History of this method which goes back over ten years. Comparison with fuel-burning furnaces, electric resistance furnaces, induction furnaces, and heating by direct passage of current. Improvement in quality and advantages obtained with the latter method. (*In German.*) Erwärmung von Stahlwalzknüppeln zur Verarbeitung in Walzwerken. ***H. Müller and W. Annen.*** *Elektrowärme*, v. 16, Dec. 1958, p. 422-427.

4456* The Heat Treatment and Flash Annealing of Aluminum Dishes for Deep Drawing. (*In Hungarian.*) Mélyhúzható alumínium lemeztárcsák hőkezelése gyorslágyítással. ***György Gyalókay.*** *Kohászati Lapok*, v. 90, nos. 11-12, Nov.-Dec. 1957, p. 526-529.

4457* Bright Annealing. Discusses techniques in considering the range of furnaces and other plant available for different bright-annealing requirements. ***A. E. Pickles.*** *Metal Treatment and Drop Forging*, v. 26, Jan. 1959, p. 7-14.

4458* Formation of the Structure of Nitrided Heat-Treating Steels. Investigations on the phenomena occurring in the marginal zone of steels containing about (1) 0.35% C, 1.1% Al, 1.1% Cr and 0.25% Mo; (2) 0.3% C, 2.5% Cr, 0.3% Mo, 0.5% Ni and 0.25% V and (3) 0.3% C, 3% Cr and 0.5% Mo as well as of alloys with titanium addition in conventional gas nitriding and nitriding under glow discharge. Effect of the initial structure and of the nitriding conditions on the nitrided case. Conclusions to be drawn particularly on the differences between the two nitriding processes and on the alloy additions. (*In German.*) Gefüge nitrierter Vergütungsstähle. ***T. M. Norén and L. Kindbom.*** *Stahl und Eisen*, v. 78, no. 26, Dec. 25, 1958, p. 1881-1891.

4459 Corrosion and Decarburization of the Ferritic Chromium-Molybdenum Steels in Sodium Coolant Systems. The purpose of this work was to investigate both corrosion and carbon transfer phenomena in sodium systems containing both ferritic and austenitic steels. Specimens were exposed at 1025 F in a high-velocity 304 stainless-steel isothermal pump loop and at 1050 F in a low-velocity 304 stainless-steel anisothermal pump loop (500 F temperature gradient) to obtain corrosion and decarburization data. All of the steels showed negligible corrosion rates (aside from carburization-decarburization reactions). Decarburization was encountered in the low-chromium steels. Results of each of these tests indicate that the magnitude of the carbon activity in one steel, in relation to another and/or in relation to the carbon activity of the sodium, determines whether an alloy is decarburized, neutral, or carburized in a sodium system. ***W. C. Hayes and O. C. Shepard.*** *U. S. Atomic Energy Commission, NAA-SR-2973*, Dec. 1, 1958, 33 pp. (UF767 Un3.1na Contin.)

METALS—MECHANICAL AND PHYSICAL PROPERTIES

4460* The Effect of Specimen Form on the Tensile Strength of Cast Iron. ***G. N. J. Gilbert.*** *British Foundryman*, v. 52, Jan. 1959, p. 28-42.

4461 Study of Austenitic Chrome-Manganese Steels. As satisfactory replacements for chrome-nickel steels. Effect of various alloying elements such as W, Ti, Mo, and V, in 14% Cr, 18% Mn steel upon rupture strength and tensile properties at room and elevated temperatures. ***A. S. Panicheva.*** *Henry Brutcher Translation No.* 4219, 10 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 5, May 1958, p. 23-27.) Henry Brutcher, Altadena, Calif.

4462 Estimation of Ductility (Creep at Rupture) of Creep-Resisting [Steels and] Alloys at High Temperatures. Criterion adopted to index the ductility of various steels and alloys in long-time service at elevated temperatures. Dependence of creep at rupture on the time to rupture. Procedure suggested for cases where long-time rupture test data are at variance with relationships considered to be of general validity. ***A. V. Stanyukovich.*** *Henry Brutcher Translation No.* 4232, 15 pp. (From *Zavodskaya Laboratoriya*, v. 23, no. 4, 1957, p. 476-484.)

4463 Stress Corrosion Cracking of Austenitic Steels at Elevated Temperatures and Pressures. Development of a (long-time) test for stress corrosion resistance in aqueous solutions, of steam superheater and steampipe steels, simulating their conditions of service. Effect of composition and concentration of test solutions, with and without access of oxygen; concentration of solutions below which steel will not succumb to stress corrosion failure. ***V. P. Sidorov and A. V. Ryabchenkov.*** *Henry Brutcher Translation No.* 4250, 11 pp. (From *Metal-*

lovedenie i Obrabotka Metallov, no. 6, June 1958, p. 25-32.) Henry Brutcher, Altadena, Calif.

4464 Effect of Lubricant on Penetration of a Diamond-Pointed Indenter Into Ductile Metals. Comparative depths of diamond indenter measurements made by authors under loads of 0 to 4 kgs. on dry specimens and on specimens coated with 0.2% solutions of stearic or oleic acid, respectively, in vaseline oil, of iron, copper, and zinc. Relationship between initial hardness of specimen and the load on the indenter needed to produce an effect attributable to the surface-active lubricant. ***V. D. Kuznetsov and A. I. Loskutov.*** *Henry Brutcher Translation No.* 4406, 8 pp. (From *Fizika Metollov i Metallovedenie*, v. 2, no. 3, 1956, p. 509-513.)

4465 Effect of Shot Peening Prior to Electroplating on the Fatigue Properties of an Alloy Steel. The results of research into the effect of shot peening, prior to electroplating, on the fatigue strength of a modified SAE 3140 alloy steel are described in this report. Eight S-N curves have been obtained on steel specimens with the following surface conditions: as-machined, shot peened, electroplated on a machined surface, and electroplated on a shot peened surface. These curves show that the specimens which were shot peened prior to electroplating with chromium, nickel, or cadmium have materially higher fatigue properties than have specimens which were not shot peened before electroplating with these metals. ***N. B. Brown.*** *Canada, Mines Branch, Research Report*, R-23, Sept. 18, 1958, 12 pp. (TN26 C16.5r Contin.)

4466 Vapor Pressure of Niobium. The Langmuir method has been used to determine the vapor pressure of niobium. An accommodation coefficent of unity was assumed. Least square treatment of the vapor pressure data yields the equation log P_{atm} - 40,169/T + 8.872. The heat of sublimation at absolute zero, $\Delta H°_0$, is 171.80±0.49 and $\Delta H°_{298.15}$ is 172.53 kcal/g atom. ***Rudolph Speiser, P. Blackburn, and H. L. Johston.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 52-53.
Speiser, P. Blackburn, and H. L. Johnston. *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 52-53.

4467 The Mechanical Properties of the Ferrite Crystal. Elastic properties; deformation; dislocations and twinning; fracture and slip. ***N. P. Allen.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 1-18.

4468 A Modified Bend Test for Hardened Tool Steels. A bend-test apparatus has been specially designed for the testing of fully hardened tool steels at atmospheric or elevated temperatures. A method is described for calculation of stresses, which makes adequate correction to classical bending formulae to enable their application to specimens behaving in a non-elastic manner. Analysis of the results of several series of experiments is made, and hypotheses are advanced for relating these properties to the 'toughness' of tool steel, a quantity which remains undefined. Various parameters are given which, it is suggested, assist in the appraisal of tool steels, whether of the plain carbon, low-alloy, or high-speed type. ***G. Hoyle and E. Ineson.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 44-55.

4469 Changes of Electric Resistance of Nickel Films With Adsorption of Hydrogen. The changes of electric resistance of annealed nickel films due to the adsorption of hydrogen have been investigated by changing the condition of preparation. ***Zenjiro Oda and Hikaru Arata.*** *Journal of Physical Chemistry*, v. 62, Dec. 1958, p. 1471-1474.

4470* Problems of Brittle Fracture. The present state of knowledge regarding the occurrence of brittle fracture with particular reference to the construction of pressure vessels. ***H. Harris.*** *Metal Treatment and Drop Forging*, v. 26, Jan. 1959, p. 15-20.

4471* Study of Some Physical Properties of Gallium Single Crystals Near the Melting Point. (*In French.*) Etude de quelques propriétés physiques des monocristaux de gallium près du point de fusion. ***Marc Erny.*** *Métaux Corrosion-Industries*, v. 33, Dec. 1958, p. 493-513.

4472* To the Problem of Maximum Mechanical Properties Within the Region of Diluted Solid Solutions. Investigation made of solid solutions of mercury in Cd and Pb, and Bi in Pb. Thermal tests under a load of 26.8 kg, and soaking time 10 min. Study made of 1) the effect of load duration (at soaking time 10 min.) by a cone at 28.7 kg load, 2) relationship between composition and diameter of the indentation on the alloys in the hardness test. (*In Russian.*) K voprosu o maksimume mekhanicheskikh svoistv vnutri oblasti razbavlennykh tverdykh rastvorov. ***V. P. Shishokin and A. E. Nikerov.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1958, no. 4, p. 207-213.

4473 Elastic Constants of α-Brasses: Room-Temperature Variation With Solute Concentration. Room-temperature elastic constant measurements have been made on a representative series of α-brasses. The variation with solute concentration of the shear constant C suggests that there is an appreciable contribution to it resulting from the onset of overlap between the Fermi surface and the (111) faces of the Brillouin zone. There is reasonable agreement between the experimentally determined magnitude of this contribution and that predicted from theory. According to the latter, there should be no corresponding contribution to the shear constant C', which prediction appears to be in accordance with experiment. ***John A. Rayne.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1125-1130.

4474 Effect of Hydrostatic Pressure on the Anomalous Hall Coefficient Reversal in Single Crystal Tellurium. ***Allen Nussbaum, John Myers, and Donald Long.*** *Physical Review Letters*, v. 2, no. 1, Jan. 1, 1959, p. 6-7.

4475 Influence of Cold Work on the Resistivity of Dilute Copper Alloys. The results reported here are not the first which show that in some cases plastic deformation of alloys leads to a reduction in residual resistivity. Of particular interest in this connection are the results of Weyerer who observed a decrease in resistivity of commercial copper after deformation. Further studies of the resistivity of dilute noble metal alloys following plastic deformation and subsequent anneal are now in progress. ***R. H. Kropschot, M. Garber, and F. J. Blatt.*** *Physical Review Letters*, v. 2, no. 3, Feb. 1, 1959, p. 91-94.

4476 Low-Temperature Specific Heats of Body-Centered Cubic Cr-Fe and Cr-Mn Alloys. The electronic structure of the transition elements in the metallic state has not been fully understood as yet. It may be hoped that additional information with regard to the electronic specific heat coefficients and other physical properties of these elements, as well as of their alloys, will help in the interpretation of their structure. ***C. T. Wei, C. H. Cheng, and P. A. Beck.*** *Physical Review Letters*, v. 2, no. 3, Feb. 1, 1959, p. 95-98.

4477 The Internal Friction of Annealed Copper at Low Temperatures. Friction was measured as a function of strain amplitude in the temperature range 20 to 300 K. Current theories are inadequate to account for the observed results. ***D. H. Niblett and J. Wilks.*** *Physical Society, Proceedings*, v. 73, pt. 1, Jan. 1959, p. 95-99.

4478* Experimental Study of the Deformation at Elevated Temperatures of Steels and Alloys. By means of various experimental techniques for determining forgeability of steels and alloys, it has been shown that forgeability may be related for a given alloy, to temperature, deformation speed, deformation process, and to the types of stress imposed on the metal, and also to the total thermal cycle: previous heating, and cooling cycle during the transformation operation. The experimental tests made include hot bend under impact, hot twist, and hot tension. (*In French.*) Étude expérimentale de la déformation à chaud des aciers et alliages. ***A. Gueussier and R. Castro.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1023-1041.

4479* On the Scattering Observed on Rotative Bending Fatigue Tests. About 80 test samples of a heat treated Ni-Cr-Mo structural steel were investigated. The statistical scatter of the results on both sides of the fatigue limit is about ± 8%, corresponding to a probability of 95%. (*In French.*) Sur la dispersion observée dans les essais de fatigue en flexion rotative. ***R. Castro and A. Gueussier.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1042-1047.

4480* Determining of the Fatigue Strength, According to L. Locati's Method, Using One Part Only. Based on the Miner's Law, the principle of the Locati's method consists of investigating one part only, and submitting this part to a series of increasing load levels. However, at each load level the part is stressed for the same number of cycles. When applied to car wheel shafts, this method shows a satisfactory agreement with the conventional techniques. (*In French.*) Détermination de la limite de fatigue suivant la méthode L. Locati utilisant une seule pièce. ***C. Daubertès. M. Renout, and R. Cazaud.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1048-1056.

4481* Low-Cycle Fatigue of Notched and Unnotched Specimens of 2024 Aluminum Alloy Under Axial Loading. A review was made of the results that have been published of experimental and theoretical investigations of low-cycle fatigue phenomena. Two experimental programs were conducted using 2024 aluminum alloy, one with notched sheet specimens, the other with unnotched round specimens. ***Theodore H. H. Pian and Richard D'Amato.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 58-27, Feb. 1958, 77 pp. (TL507 Un3.18t Contin.)

4482 The Tensile Properties of Pure Plutonium. As cast and as cast delta phase annealed specimens were tested at an average temperature of 31 C. ***H. R. Gardner and J. M. Jefferes.*** *U. S. Atomic Energy Commission, HW*-57130, Aug. 6, 1958, 16 pp. (UF767 Un3.1hw Contin.)

4483 Thermal Ionization at Hot Metal Surfaces. Ionization on hot tungsten, tantalum, and rhenium surfaces was studied. An atomic beam of neutral atoms effused from a Knudsen-type effusion vessel and struck a hot filament of the metal being studied. A temperature-dependent fraction of these atoms was ionized. This filament served as the ion source of a 60-degree-sector single-directional focusing mass spectrometer. According to the Saha-Langmuir theory of surface ionization the temperature dependence of ionization is related to the difference between the ionization potential of the impinging atom and the work function of the surface under consideration. The temperature dependence of the positive ion current produced by barium atoms impinging onto tugnsten, tantalum, and rhenium filaments was measured over a wide range of filament temperatures. At temperatures higher than 2500 K excellent agreement with th Saha-Langmuir theory was obtained. Using the value of 5.21 electron volts for the ionization potential of barium we obtain 4.58 ± 0.01 ev for the work function of tungsten and 4.23 ± 0.03 ev for the work function of tantalum. Both values are in excellent agreement with generally accepted values determined by independent means. On rhenium we fiind the Ba^+ ion current to be essentially independent of temperature, indicating a work function equal to or appreciably higher than the 5.21 ev ionization potential of barium. ***Joseph R. Werning.*** *U. S. Atomic Energy Commission, UCRL*-8455, Sept. 1958, 63 pp. (UF767 U3u Contin.)

4484 Effect of Residual Stress on Fatigue Strength. Rotating tests are reported on notched bars preloaded to introduce residual stress. The effect depends on material and notched sharpness. ***D. S. Dugdale.*** *Welding Journal*, v. 38, Jan. 1959, p. 45s-48s.

See also: **4371** (metal behavior at −300F); **4515** (deformation of U); **4522** (creep of Ni-Cr alloy); **4536** (deformation of Ag); **4547** (fatigue of Al-Cu alloys); **4600** (Al and Zr clad nuclear fuel elements).

METALS—MECHANICAL WORKING

4485* Electrolytic Machining of Honeycomb. Anode workpiece is secured in low melting alloy; rotating abrasive wheel acts as cathode. Finished surface is free of burrs. *Aircraft and Missiles Manufacturing*, v. 2, Jan. 1959, p. 50-52.

4486* Drop-Hammer Tools From Epoxies. Epoxy drop hammer tools, whether they are metals, faced with plastic, or of the more recent all-plastic construction, have enjoyed wide acceptance by aircraft and missile manufacturers. ***John Delmonte.*** *Aircraft and Missiles Manufacturing*, v. 2, Feb. 1959, p. 38-40.

4487* Tape Controlled Measurement for Machining and Inspection. I. Types of Signals, Purposes and Types of Measurement. ***O. S. Puckle.*** *Automation Progress*, v. 4, Jan. 1959, p. 4-7.

4488 Tooling With Epoxides. The attraction of these resins for such applications lies in the facility with which they may be cast and laminated, strong adhesion to reinforcing materials, dimensional stability, ease of repair, and resistance to corrosion. These properties enable them, in the case of working tools, to be used as effective and cheaper alternatives where the expense of conventional tooling is not justified. *British Plastics*, v. 32, Jan. 1959, p. 24-28.

4489* A Sliding-Block Type Cutting Test Apparatus. Describes construction and operation of apparatus, using a sliding block, for orthogonal cutting tests. ***Keiji Okushima.*** *Bulletin of JSME*, v. 1, no. 4, Nov. 1958, p. 338-342.

4490* Grinding Sintered Carbide, Especially Sintered Carbide Cutting Tools, With Diamond Grinding Wheels. Grinding tests on a masonry drill precision grinding and lapping machine. ***G. Pahlitzsch and G. Rafflenbeul.*** *Industrial Diamond Review*, v. 18, Dec. 1958, p. 225 + 7 pages. (Translated from Werkstatt & Betrieb, v. 91, no. 5, 1958.)

4491* An Examinaton of Lubrication With Soap, Using Radioactive Sodium Stearate. Describes an experimental study of the behavior of a soap coating on rectangular mild steel bars drawn slowly under plane strain conditions between hard cylindrical dies. Loads up to 5 tons were applied to reduce the cross-section of the bars by 5-30% in one pass. Purified sodium stearate was neutron-activated and was used as the lubricant. It is found that although the drawing conditions are designed to discourage hydrodynamic lubrication, films of soap over 1000 Å thick can pass between the dies and the specimens. The soap film thickness decreases steadily as the percentage reduction of area of the specimen is increased and eventually at about 30% reaches a value of 600 Å, comparable with the maximum height of the surface asperities. At this stage the smooth surface of the specimen can be seen to be damaged and "pick-up" is found to occur. ***J. Golden, P. R. Lancaster, and G. R. Rowe.*** *International Journal of Applied Radiation and Isotopes*, v. 4, nos. 1/2, Dec. 1958, p. 30-35.

4492 New Grinding Technique Boosts Single-Point Tool Life. New tool grinder, manufactured by the DeVlieg Machine Co., produces a conical tool point radius and a uniform relief angle for all cutting edges. With detailed protractor settings, duplicate tools for production jobs can be ground quickly and accurately. *Iron Age*, v. 183, no. 2, Jan. 8, 1959, p. 66-68.

4493 Mechanical Manipulation in Bar Mills. Examines some of the mechanical devices available for handling pieces through the guides and passes of bar mills. Operational cost savings can result from the installation of mechanical manipulators, and heavier work pieces can be handled. . . Automation makes the work of the operating crews safer and less laborious. ***E. C. Peterson.*** *Iron and Steel Engineer*, v. 36, Jan. 1959, p. 67-78.

4494 The Effect of Rolling Unstable Austenitic 0.76% Carbon Steel at 220-300°C. Red-hot 0.76% C steel strip was quenched in a salt bath (220-300 C) and immediately cold-rolled at reductions up to 50%. The strip was then either air-cooled ("austenrolling"), or held isothermally and cooled ("ausroltempering"). The effect of these treatments and variation of rolling speed on final microstructure and hardness was studied. The impact resistance of unnotched specimens of the austenrolled strip was superior to that of quench-tempered specimens and bainite-martensite specimens in the 625-750 VPN hardness range. A theory is proposed for this accelerated breakdown of austenite. ***P. R. V. Evans and Hugh O'Neill.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 34-44.

4495* Lubricants in the Forming of Aluminum. A number of lubricants of known composition were evaluated in a laboratory slow-speed draw test by determining the forces obtained during the drawing. Shop test results are reported corroborating laboratory findings in the drawing of 2024, 5052 and 7075 aluminum alloys. ***Marco Petronio.*** *Lubrication Engineering*, v. 14, Dec. 1958, p. 510-522.

4496 Hydroforming Difficult Shapes. Shows how to produce re-entrant openings, extra-deep drawn components, and

similar "difficult" pieces from sheet metal by adapting basic Hydroform tooling. ***Richard Paulton.*** *Machine Design*, v. 31, Feb. 5, 1959, p. 122-123.

4497* High-Speed Machining With Disposable Inserts. Without interrupting the machining cycle, the operator indexes one of the inserts. New cutting edge will repeat within an accuracy of 0.002 inch. ***C. S. Currie, Jr.*** *Machinery*, v. 65, no. 5, Jan. 1959, p. 95-96.

4498* Hardened Bearing Races Machined With Cemented-Oxide Tools. It may be practical to eliminate all but finish-grinding operations by machining steel bearing races, 60 to 63 Rockwell C, with cemented-oxide tools. ***H. J. Siekmann.*** *Machinery*, v. 65, no. 5, Jan. 1959, p. 109-111.

4499* Cutting-Tool Materials—Today and Tomorrow. A digest on high-speed steels, tungsten carbide, titanium carbides, ceramics, titanium boride, and cemented diamonds. ***Robert T. Hook.*** *Machinery*, v. 65, no. 5, Jan. 1959, p. 116-119.

4500 Production of Ball and Roller Bearings. Methods employed by the Hoffman Manufacturing Co., Ltd. *Machinery (London)*, v. 93, Dec. 24, 1958, p. 1448-1456.

4501 Some Possibilities of Explosive Forming. Explosive forming offers considerable promise as a means of overcoming some of the difficulties with which the production engineer is confronted, particularly in connection with certain of the newer work materials. The comparative simplicity of the plant required is likely to be one of the principal attractions of this process. *Machinery (London)*, v. 94, Jan. 14, 1959, p. 63 + 1 page.

4502 Grinding Operations on Compressor Vanes. More than 1,300 stationary compressor vanes—and approximately the same number of rotating compressor blades—are required for each J-75 jet propulsion unit. They are made from AMS 5613 and 5616 stainless-steel precision forgings with a hardness of 35 to 45 Rockwell C. Quantity production of these components is accomplished by form-grinding techniques. *Machinery (London)*, v. 94, Jan. 14, 1959, p. 77-83.

4503 Wilkins & Mitchell Hot Brass Stamping Press and Automatic Furnace Installation. Hot brass stamping press and automatic furnace installation demonstrated. *Machinery (London)*, v. 94, Jan. 14, 1959, p. 87-88.

4504 Slicing and Dicing Operations on Crystals of Silicon and Germanium. Special methods have been developed for the large-scale manufacture of these parts to dimensions of 0.035 in. square by 0.013 in. thick within limits of ± 0.002 in. *Machinery (London)*, v. 94, Jan. 14, 1959, p. 92-94.

4505 Static-Dynamic Forging. Belgrade University has a new machine for static-dynamic forging. Tests carried out on the machine are discussed and comparative results obtained by only static, only dynamic, and combined static-dynamic actions are given, as well as results obtained by static-dynamic forging at various speeds. ***P. Stanković.*** *Metal Treatment and Drop Forging*, v. 25, Dec. 1958, p. 489-494.

4506 Rolling Mill for Processing Nuclear Fuel Element Materials. Depending upon the design of the reactor, fuel elements can take a variety of shapes and configurations. In addition to containing uranium, thorium, and plutonium in metallic or compound form, their production may involve nonfissionable materials such as stainless steel, aluminium, magnesium, zirconium, beryllium, titanium, nickel, chromium, copper, silicon, niobium, and molybdenum and their alloys. The mill incorporates the use of four separate roll configurations which are automatically and remotely interchanged. *Metallurgia*, v. 58, Dec. 1958, p. 286-288.

4507* Broaching From Bar Saves 14 Operations. Tells how small awkward-shaped components previously milled are now broached from the bar in a single setting and up to 14 operations are being saved on each component. *Metalworking Production*, v. 102, no. 51, Dec. 19, 1958, p. 2211-2214.

4508* Combined Hot Forging and Cold Forming Produces 8 in. Shells. A combination of hot forging and cold forming, developed by the American Car and Foundry Division of ACF Industries, produces superior quality 8-in. howitzer shells. Advantages include: less billet material, low-carbon steel, simpler heat-treatment, and less machining. *Metalworking Production*, v. 102, no. 51, Dec. 19, 1958, p. 2220-2221.

4509* Applications of Ceramic Cutting Materials and Causes of Wear of Hard Metal Tools. ***Herwart Opitz.*** *Microtecnic* (English Edition), v. 12, no. 5, Oct. 1958, p. 267-288.

4510 Copper Alloys for Those Small Tubular Parts. Easily drawn, swaged, flared, pierced, bent and joined—Cu alloy tubing can be shaped to solve many design problems. Here are the ground rules for best results. ***D. S. Granniss.*** *Product Engineering*, v. 30, no. 5, Feb. 2, 1959, p. 44-46.

4511* Fuel Elements (Uranium Clad With Zirconium) Produced by Co-Extrusion. Description of a process for making fuel elements for atomic reactors. Contact of the most intimate possible kind is achieved between the fuel and the sheath by the simultaneous extrusion of the two elements. Genuine welding between the two metals is effected. This can be subsequently improved by a heat-treatment which causes diffusion. (*In French.*) Les éléments combustibles uranium gainé de zirconium obtenus par coextrusion. ***R. Montagné, A. Winogradzki, C. Saure, and J. Buffet.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1073-1078.

4512* Grinding Sulfurized Tool Steels. Sulfur additions make high-vanadium tool steels easier to grind, the improvement being greatest for those steels that are most resistant to grinding. ***L. P. Tarasov.*** *Tool Engineer*, v. 42, no. 2, Feb. 1959, p. 77-80.

4513* Fabricating Stainless Steel. II. Forming. Guides for product and tool design for efficient forming processes on each class of stainless steel. ***Richard E. Paret.*** *Tool Engineer*, v. 42, no. 2, Feb. 1959, p. 97-100.

4514* Hot-Forming Titanium With Adjustable-Section Dies. Development of techniques for hot-forming corrugations. Developments in the design and use of the dies. ***Ed Selmer.*** *Tool Engineer*, v. 42, no. 2, Feb. 1959, p. 101-103.

4515 The Rolling Pressures of Uranium Sheet and Plate. A cam plastometer was built and used for testing depleted uranium specimens in compression at several constant true strain rates and temperatures. From load and time measurements, true stress versus true strain curves were calculated. Orowan's method, modified to take into account both roll flattening and inhomogeneity of deformation, was used to calculate the roll pressure distribution along the arc of contact during the rolling of depleted uranium into sheet and plate. Also calculated were the total roll pressure, total roll separating force, total torque, power requirements, neutral angle and height, and instantaneous values of the true strain rate and the compression rate. ***J. E. Hockett.*** *U. S. Atomic Energy Commission*, LA-2233, Jan. 8, 1959, 159 pp. (UF767 U3La Contin.)

See also: **4368** (design of forgings); **4600** (Al and Zr clad nuclear fuel elements); **4617** (operations research in a rolling mill); **4729** (machining nylon); **4734** (machining plastics).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

4516* Effect of Casting Temperature on the Graphitization of White Cast Iron. The number of graphite inclusions and the rate of graphitization of white cast iron decrease with an increase in the casting temperature despite interphase surface growth. (*In Ukrainian.*) Vpliv temperaturi zalivki na grafitizatsiiu bilogo chavunu. ***K. P. Bunin and O. M. Galemina.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1958, no. 11, p. 1199-1203.

4517* X-Ray Diffraction Study of Vanadium-Germanium Alloys. Seven alloys containing 29.1-83.3 at.% of V were investigated by X-ray diffraction and metallographic methods. (*In Ukrainian.*) Rentgenostrukturne doslidzhennia splaviv vanadiiu z germaniem. ***É. I. Gladyshevsky and Y. B. Zuzma.***

Akademiia Nauk Ukraïns'koï RSR, Dopovidi, 1958, no. 11, p. 1208-1211.

4518 Department of Defense Titanium Sheet-Rolling Program. Thermal Stability of the Titanium Sheet-Rolling-Program Alloys. *E. S. Bartlett, D. N. Williams, H. R. Ogden, and R. I. Jaffee.* *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 46E, Nov. 25, 1958, 39 pp. (TN799.T5 B32.7t Vis.)

4519 Solution of Graphite in Austenite. Experiments aimed at testing the correctness of various hypotheses advanced about the "healing" (filling) of pores (self-diffusion; plastic deformation; forces of attraction) resulting from graphite passing into solution in austenite, and at shedding light on the effect of the state of austenite on the rate of healing. ***K. P. Bunin and A. A. Baranov.*** *Henry Brutcher Translation No.* 4276, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 15-18.) Henry Brutcher, Altadena, Calif.

4520 Microstructure of Low-Carbon Steel Developed by Electropolishing and Electroetching. Description of a new electrolytic polishing + electrolytic etching procedure for microstructures of low carbon steel and technical iron. Advantages of electrolytic etching over ordinary etching for developing deformed structures. ***B. S. Kasatkin.*** *Henry Brutcher Translation No.* 4345, 4 pp. (From *Zavodskaya Laboratoriya*, v. 24, no. 7, 1958, p. 842-843.)

4521 Distribution of Alloying Elements Between Solid and Liquid Phases in Alloys. Microradiographic study of distribution of silver, copper, and zinc between solid and liquid phases in binary aluminum alloys. Nature and origin of segregation films at the solid/liquid interface. Development of dendritic segregation. Findings on alloys with a columnar structure. ***B. A. Movchan.*** *Henry Brutcher Translation No.* 4378, 5 pp. (From *Izvestiya Akad. Nauk SSSR, Otd. Tekh. Nauk*, no. 4, Apr. 1958, p. 122-123.) Henry Brutcher, Altadena, Calif.

4522 Study of Structural Changes in Nickel-Chromium Alloy During Creep. X-ray study and micrographic analysis of an 80.2% Ni, 19.8% Cr alloy. Data on total strain, creep rates during the different stages of creep, and hardness as function of state of structure before the test. Possibility of lengthening the service life of alloys by selecting an initial structural state that will give a minimum creep rate in the second stage of creep. ***G. Ya. Kozyraskii, V. A. Kononenko, and P. N. Okrainets.*** *Henry Brutcher Translation No.* 4402, 9 pp. (From *Izvestiya Akad. Nauk SSSR Otd. Tekh. Nauk*, no. 8, Aug. 1958, p. 90-92.) Henry Brutcher, Altadena, Calif.

4523 Diffusion in Metals. Lectures given at the "Seminar on the Physics of Metals" held at Eindhoven, Netherlands, September 10 and 11, 1956. Includes discussions of the problem of correlation of the movements of atoms, effect of structural defects on diffusion, the Kirkendall effect, diffusion of tracer atoms, and diffusion of an elastic tension. (*In French.*) La diffusion dans les metaux. 124 pages. 1957. Bibliotheque Technique Philips, Eindhoven, Netherlands. (QC185 C69d)

4524* Further Contribution to the Constitution of Austenitic Steels Intended for Service at Elevated Temperatures. Studies on austenitic Ni-Cr and ferritic Cr steels. The practical applicability of derived equations is examined for the qualitative determination of constitution and of structure based upon chemical composition. (*In Czech.*) Další příspěvek ke konstituci austenitických ocelí pro službu za vyšších teplot. ***František Poboril and Marcela Zezulová.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1061-1069.

4525* Constitution of Fe-Cr-Mn Alloys. As applied to commercially important Fe-Cr-Mn alloys (CrMn, resp. CrNiMn steels) there follows an important conclusion: Once the manganese content in these steels is high enough so that the alpha phase disappears from the structure and the latter becomes austenitic, further increase of the manganese content should be avoided as this may cause a danger of sigma phase or—at high temperatures—delta ferrite occurrence. (*In Czech.*) Konstituce slitin Fe—Cr—Mn. ***Bedřich Potůček.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1070-1076.

4526* Contribution to the Question of Differential Thermo-Analysis Use for the Study of Alloys and Metals Constitutional Diagrams. Possibilities of the differential thermoanalysis use for metallic materials are given. A relatively simple and accessible apparatus working according to the given principle is described. It is thus possible to obtain valuable data concerning crystallization of alloys which have not been studied until now. The advantage of this method consists in the relatively small quantity of test material and in quick execution in a large temperature range. (*In Czech.*)Příspěvek k otázce použití diferenciální termické analysy k sledování rovnovážných diagramů slitin a kovů. ***Hanus Tůma and Miloslav Vyklický.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1077-1081.

4527* Observations on the Theory of Aging of Alloys. From the Clausius-Clapeyron equation it is deduced that the nature of the solubility curve is determined by the degree of volume change of the system and the reaction heat during solution and precipitation of the element from the solution. The cause of the supersaturation in the solid solution during quenching is considered to be the augmentation of the thermodynamic and chemical potential of the particle due to the small radius of curvature of its surface. The critical size of the precipitation nuclei is defined by the equality of the chemical and thermodynamic potential of this nuclei and the chemical potential of the precipitation element in the solid solution. The critical size determined in this way agrees for the spherical nuclei with the usual definition. (*In Czech.*) Poznámky k teorii vytvrzování slitin. ***Marie Ryšavá.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1087-1092.

4528* Precipitation of Carbides and Nitrides During Drawing of 12% Chromium-Steel Low in Carbon. Processes taking place during drawing of 12% chromium steel low in carbon were studied. Besides classical metallographical methods, electron-microscopical and radiographical methods were used. It was found that the course and mechanism of carbide reactions during the martensite decomposition is the same in these steels as it is in steels of similar composition studied by Kuo and Heiskanen. During this precipitation the different types of carbides do not have a specific shape which would differentiate them one from another. In sorbite and in ferrite acicular precipitate still appear during drawing; this was determined as chromium nitride, Cr_2N. This chromium nitride is the only kind of precipitate appearing within the ferrite grain. Thermochemical considerations show that a relatively small amount of dissolved nitrogen will be sufficient for the precipitation of nitrides at temperatures under Ac_1. (*In Czech.*) Precipitace karbidů a nitridů při popuštění 12procentní chromové oceli s nízkým obsahem uhlíku. ***Jaroslav Koutský and Jaroslav Ježek.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1098-1105.

4529* A New Method for Metallographic Determination of the Cross-Section Value Distribution of Globular Grains and of Their Number in the Space of Metallic Specimens. The authors derived the relation between the spatial cross-section distribution of the grains and that of the cross-sections of lines of intersection of the grains in the plane of a metallographic specimen and the relation between the number of grains in a volume unit and that of lines of intersection of the grains in the corresponding unit surface of the plane of metallographic specimen. To the solution they used a mathematical model designed on the basis of following suppositions: The grains are of globular form, they are distributed accidentally in the space of the specimen and the cross-section value distribution follows the logarithmicnormal law. They reexamined experimentally the validity of suppositions applied on a specimen of eutectoid steel, the structure of which consisted in gloubular cementite grains stored in ferritic base matter. (*In Czech.*) Nový způsob metallografického zjišťování rozdělení velikosti průměrů kulových zrn a jejich počtu v prostoru kovových vzorků. ***Stanislav Drápal and Vratislav Horálek.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1105-1110.

4530* Contribution to the Theory of Strength Limit States of Steel. Deals with the analysis of origin and development of fissures in metals, especially in ferritic grains of steels during deformations. Demonstrates that the origin of cohesion failures lie in plastic deformations whose nature and extent are depending on the stress conditions. The changes in the increase of fissure density were investigated to the critical state when the fissures flow together and when the conditions favoring the accelerated extension into the fracture surface are reached. The

influence of the test sample dimensions, of the load increase speed and the temperature of material can be investigated on theoretic grounds and a base can be created for practice and evaluation of mechanical properties tests of various materials, especially of steels, under dynamic and vibratory stress. (*In Czech.*) K teorii mezních stavů pevnosti oceli. ***Jaroslav Němec.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1111-1116.

4531* Contribution to the Question of Conchoidal Fracture Occurrence. It was found that the tendency of steel to the formation of this type of fracture can be practically suppressed by the use of pouring under reduced pressure which decreases the hydrogen content, produces a narrowing of the columnar layer of long-axed dendrites, and supports the occurrence of a globular structure. (*In Czech.*) Příspěvek k otázce výskytu lasturových lomů. ***Zdeněk Eminger.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1141-1152.

4532 Physical Damage Brought About by Thermally Cycling Uranium Through Its Phase Changes. Physical damage induced by thermally cycling uranium through its phase changes is shown to be caused by macrotransformation stresses and the different mechanical strengths of the polymorphs. The influence of prior history and thermal conditions during testing on the rate of progress of damage is reported. ***S. N. Buckley, A. G. Harding, and M. B. Waldron.*** *Institute of Metals, Journal*, v. 87, pt. 5, Jan. 1959, p. 150-154.

4533 The Constitution of Bismuth-Uranium Alloys in the Composition Range 0-35 Atomic Per Cent Uranium. Differential thermal analysis in a positive pressure of argon was used to determine liquidus and solidus relationships. ***P. Cotterill and H. J. Axon.*** *Institute of Metals, Journal*, v. 87, pt. 5, Jan. 1959, p. 159-160.

4534 Solidification Characteristics of Continuously Cast Low-Carbon Steel. Typical cast structures are presented to show how solidification process has influenced operating problems as well as the properties and performance of the product. Structures obtained in continuously cast rimming steel sections. Typical segregation curves. A mechanism is proposed for the solidification of continuously cast rimming steel. ***M. Tenenbaum, C. F. Schrader, and L. Mair.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 20-33.

4535 The Kinetics of the Formation of Bainite in High-Purity Iron-Carbon Alloys. The isothermal transformation of austenite to bainite at temperatures in the range from 200-450 C was studied in three Fe-C alloys (0.77, 1.07, and 1.20 wt-% C) and a plain carbon steel (0.65 wt-% C) by the measurement of changes in electrical resistivity. The processes of austenitizing and rapidly cooling wire specimens to the reaction temperature were accomplished by direct electrical heating followed by gas-quenching. The resistivity and temperature of the specimen during quenching and subsequent isothermal reaction were recorded continuously. It has been established that a marked change in the kinetics of the transformation occurs over the temperature range 300-350 C. ***S. V. Radcliffe and E. C. Rollason.*** *Iron and Steel Institute, Journal*, v. 191, pt. 1, Jan. 1959, p. 56-66.

4536 Self-Diffusion in Silver During Plastic Deformation in Extension and Compression. Self-diffusion of Ag^{110} in silver single crystals subjected to simultaneous deformation at 800 and 900 C was studied using the sectioning technique. The crystals were oriented for duplex slip and were deformed in extension and compression at constant strain rates in the range 1 to 28 x 10^{-5} $sec.^{-1}$. Total strains as large as 0.33 were attained. Recrystallization occurred in the initially single crystal specimens during diffusion-deformation under all conditions except tension at 800 C. ***J. B. Darby, Jr., C. T. Tomizuka, and R. W. Balluffi.*** *Journal of Applied Physics*, v. 30, Jan. 1959, p. 104-112.

4537 Freezing of Aluminium and Its Alloys. Conditions that influence crystal growth and mechanism of freezing of super-purity Al and an Al-Si alloy with and without hardener additions. Includes effect of growth rate anisotropy. ***R. M. Sergeant.*** *Metal Industry*, v. 94, Jan. 16, 1959, p. 43 + 3 pages.

4538 The Constitution of Thorium Alloys. Thorium reacts readily with the atmosphere and with water at elevated temperatures. Since it is a very weak, ductile metal, alloying is important; unfortunately the large atomic diameter of Th restricts the number of systems in which extensive solid solutions are found. Available data is reviewed for 37 binary Th systems. ***F. A. Rough, Arthur A. Bauer, and H. A. Saller.*** Paper from "The Metal Thorium", p. 316-351, 1958. American Society for Metals, Cleveland. (TN799.T4 M56)

4539 Recrystallization of Molybdenum. A comparison is made between the recrystallization behavior of wires fabricated from ingots of cast metal and ingots made by sintering pressed powder compacts. ***G. L. Davis and P. J. Burdon.*** *Metal Treatment and Drop Forging*, v. 25, Dec. 1958, p. 495-501.

4540* Phase Diagrams Covering Pressure, Temperature and Composition. Use of Thermodynamic Data to Elucidate the Cadmium-Zinc Binary System. Presents a three-dimensional pressure-temperature-composition (P-T-X) diagram for the cadmium-zinc system. ***A. G. Guy and Shotaro Morozumi.*** *Metal Treatment and Drop Forging*, v. 26, Jan. 1959, p. 21-26.

4541* Physical and Metallurgical Properties of Iron-Silicon Alpha Alloys. Constitution diagram and physical properties. Preparation of single crystals. Metallographic techniques. Energy of grain boundaries. Anisotropy of grain growth; polygonization. (*In French.*) Propriétés physiques et propriétés métallurgiques des alliages fer-silicium alpha. ***Pierre Coulomb.*** *Métaux Corrosion-Industries*, v. 33, Nov. 1958, p. 431-440.

4542* Original Micrographic Methods for the Examination of Different Nuclear Metals and Alloys. Method of preparation of metallographic samples (polishing and etching), and results obtained on Pu, U, Th, Nb, Ta, V, and Al-Pu, U-Pu, and Th-Nb alloys. (*In French.*) Méthodes micrographiques originales pour l'examen de différents métaux et alliages nucléaires. ***H. Monti.*** *Métaux Corrosion-Industries*, v. 33, Dec. 1958, p. 481-492.

4543* Effect of Phase Transformation on the Rate of Self-Diffusion. Investigation of the effect of eutectoid transformation (austenite-pearlite) in an 0.78% C steel on the self-diffusion of iron. Experiments on measuring the action of polymorphic $\alpha \rightleftarrows \gamma$ transformation on self-diffusion rate. (*In Russian.*) Vliianie fazovykh prevrashchenii na skorost' samodiffusii. ***S. Z. Bokshtein, A. A. Zhukhovitskii, S. T. Kishkin, and E. R. Mal'tsev.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1958, no. 4, p. 158-161.

4544* Effect of Heating Rate on the Fine Structure of Nickel Iron. Effect of conditions of induction heating on change in structure, second order stresses, and hardness. (*In Russian.*) Vliianie skorosti nagreva na tonkuiu strukturu nikelevogo zheleza. ***I. N. Kidin.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1958, no. 4, p. 225-228.

4545 The Initial Stages of Growth of Oriented Copper Nuclei on Single Crystal Surfaces of Silver. Layers of metallic copper of less than 1 Å in average thickness have been deposited in a controlled manner on smooth (III) surfaces of silver inside an electron diffraction camera. It is found that an electron diffraction pattern from oriented copper nuclei appears suddenly at some critical thickness. This critical thickness decreases with increasing substrate temperature, being about 0.9 Å at room temperature and 0.2 Å at 300 C. Possibilities for the initial structure of the deposit, and for the change which occurs at the critical thickness, are considered, and the effect of substrate temperature is discussed. ***E. Grunbaum, R. C. Newman, and D. W. Pashley.*** *Philosophical Magazine*, v. 3, ser. 8, Dec. 1958, p. 1337-1341.

4546 Surface Properties of Etched Tungsten Single Crystals. An examination of the surface properties of chemically etched W single crystals was made to determine the possibility of developing a macroscopic surface with adsorption properties equivalent to an ideal crystal plane. The etching appeared to have produced a surface which was homogeneous on a microscopic level. Thermionic emission was observed to be identical for the three crystallographic directions, [112], [11$\bar{2}$], and [110], with a value of $\phi_0 = 5.25 \pm 0.05$ v. Surface ionization measurements gave the same value of work function within experimental error. ***F. L. Hughes, H. Levinstein, and R. Kaplan.*** *Physical Review Letters*, v. 2, no. 3, Feb. 1, 1959, p. 133.

4547* **Investigation on the Structural Modifications of Aluminum-Copper Alloys During Fatigue.** The author carried out tests on notched specimens, believing that the steep stress-gradient at the root of the notch might bring about a compensation of the Forsyth-Stubbington effect because of a diffusion of Cu from the more lightly stressed zones, where the Cu concentration retains its original value, to the more highly stressed zones to the extent that the Cu precipitates out. The fatigue curves obtained with notched specimens should have a limiting value if the diffusion is sufficiently rapid and this is, in fact, the case. (*In French.*) Etude sur les modifications structurales des alliages Al-Cu pendant la fatigue. ***F. Gatto.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1085-1090.

4548 Dislocation Interactions in Face-Centred Cubic Metals, With Particular Reference to Stainless Steel. Experiments by transmission electron microscopy on thin foils of stainless steel have enabled the interaction of dislocations on different slip systems to be observed in detail. Interactions are most frequently observed in piled-up groups as a result of attractions between the piled-up dislocations and isolated dislocations on other systems. The combination of dislocations takes place over short lengths only, leading to the formation of short segments of the resultant dislocation and of networks. The interactions are first discussed theoretically in terms of undissociated dislocations and then in terms of ribbon dislocations. ***M. J. Whelan.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 1, 1959, p. 114-137 + 8 plates.

4549* **Studies on Surface Layer of Polished Metals by Means of Electron Diffraction and by Electrical Contact Resistance Measurements.** Concerns efforts to find a correlation between the information provided by electron diffraction and electrical contact resistance measurements with polished surfaces. ***Masahisa Matsunaga.*** *Tokyo University, Institute of Industrial Science, Reports*, v. 7, no. 5, Mar. 1958, p. 225-252.

4550 Recovery of Lattice Expansion of Irradiated Molybdenum. The lattice expansion of commercial Mo, irradiated at an average temperature of 35 C to various fast neutron exposures from 6.5×10^{16} to 2.3×10^{19} nvt, was measured by X-ray diffraction. The increase in cell dimensions was 0.011% at the lowest exposure and 0.041% at the highest exposure. Upon annealing the lattice expansion, three thermal recovery processes were noted; one at 100-200 C, one near 400 C and one from 500-800 C. The first process, which annealed 20-30% of the total radiation induced lattice expansion, is grossly characterized by first order kinetics but a unique activation energy was not determined. This process is believed to represent trapping of interstitials by small impurity atoms. The 500-800 C process, which removes the largest part of the lattice expansion, is characterized by an activation energy of 2.5 ± .5 ev. ***D. L. Gray.*** *U. S. Atomic Energy Commission*, HW-57903, Nov. 1, 1958, 16 pp. (UF767 Un3.1hw Contin.)

4551 Vacancies and Other Point Defects in Metals and Alloys. Six papers presented at a Symposium held at the Atomic Energy Research Establishment, Harwell, Berks., December 10, 1957, on lattice defects and their effects on diffusion and mechanical and physical properties. 238 pp. 1958. The Institute of Metals, London. (TA460 In7v)

4552* **AlB_{10}, a New Phase, and a Critique on the Aluminum Borides.** As a result of a critical review of the four reported aluminum boride phases, it is shown that only three (AlB_2, αAlB_{12}, and βAlB_{12}) are authenticated. The fourth, "monoclinic AlB_{12}", is identified with rhombohedral, elemental boron. A new, well-defined aluminum-boride phase, AlB_{10}, is described. ***J. A. Kohn, Gerald Katz, and A. A. Giardini.*** *Zeitschrift für Kristallographie*, v. 111, no. 1, Dec. 1958, p. 53-62.

See also: **4003** (crystal growth); **4103** (structure of Ni electrodeposits); **4418** (structure of polished silver).

METALS—POWDER

4553 Alumina Cermets. Properties and applications of three new types of cermets, having alumina as the ceramic constituent, now made and supplied by Haynes Stellite Company, Division of Union Carbide Corp. *Design News*, v. 14, Jan. 19, 1959, p. 22-23.

4554 Electrodeposition of Powders for Powder Metallurgy. In powder production, cathode current densities are much higher than those of refining; loosely adherent deposits are produced. These are dried, surface oxides removed, and classified by screening. Important electrolytic powders are those of Cu, Fe, Ni, Zn, some alloys, as well as duplexes. Operating details are reviewed. ***C. L. Mantell.*** *Electrochemical Society, Journal*, v. 106, Jan. 1959, p. 70-74.

4555* **Manufacture of Iron Powder.** Compares the various techniques used for manufacture of iron powder for the mass production of sintered machine parts. (*In Czech.*) Výroba práškového železa. ***Jaroslav Kubelík.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1129-1131.

4556 Ceramic-Metal Materials. Review of a symposium "The Powder Metallurgy of Ceramic-Metal Materials" held under the auspices of the Powder Metallurgy Joint Group of the Institute of Metals and the Iron and Steel Institute, on December 16-17, 1958. *Metal Industry*, v. 94, Jan. 9, 1959, p. 23-26.

4557* **The Lead Bronze Bearings Manufactured by Means of Powder Metallurgy.** The casting of lead bronze containing 30 to 40% Pb (an excellent antifriction metal) is very difficult because of excessive liquation of lead. The powder metallurgy opens an advantageous way to manufacture the thick walled self-lubricating bearings and also the thin-walled babbitt lined axle bearing steps of steel. The use of fine pulverized lead perfectly free of oxides, if necessary with small addition of graphite, prevents the growth of the pressed pieces and the "sweating" of lead. A method of manufacture of thick-walled self-lubricating bearings of lead bronze with a cavity for oil has been developed. The thin-walled axle bearing steps can be manufactured in two ways: either by preparing by rolling a band of pulverized lead bronze which is then bonded to a copper-coated steel plate by sintering or the powder metal is sintered on a copper-coated steel plate and afterwards compressed by rolling. The methods of powder-metal rolling now in use and a new method of rolling between rolls one under another by means of a paper band are discussed. (*In Czech.*) Ložiska z olověného bronzu vyráběná způsoby práškové metalurgie. ***Zdeněk Ministr.*** *Hutnické Listy*, v. 13, no. 12, Dec. 1958, p. 1132-1137.

4558 Furnace Sintering of Metals and Ceramics. II. Sintering of stainless steel powders, Alnico magnets, Mo and Ta carbides, Ti and Zr powders, powder rolled products, and oxide materials is described. ***R. L. Harper.*** *Industrial Heating*, v. 25, Dec. 1958, p. 2446 + 4 pages.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

4559* **Optics in Quality Control.** Compressor-vane airfoil on J-75 and J-52 engines checked with contour projector by Thompson Products; Stratos uses variation for precision gears. *Aircraft and Missiles Manufacturing*, v. 2, Jan. 1959, p. 22-23.

4560* **Welded Rockets Are Inspected With Magnetic Particle.** A highly portable permanent magnet yoke allows thorough in-line magnetic particle inspection of thrust chamber band welds. *Industry & Welding*, v. 32, Feb. 1959, p. 34 + 1 page.

See also: **4391** (inspection of aircraft corrosion); **4487** (tape-controlled inspection).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

4561* **Production of Heavy Unstable Particles in Extremely Energetic Nucleon-Nucleon Collisions.** Possible reaction schemes are established on the basis of Gell-Mann's theory. In order to apply the Fermi-Landau thermodynamical

model to the production of heavy unstable particles, their interaction with pions is investigated. Experimental results are not contradicted. ***G. Domokos.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 9, nos. 1-2, 1958, p. 49-62.

4562* Measurement of Absorption in Graphite of Electrons From Meson μ Decay. Results compare well with the absorption curves calculated by assuming a linear relation between the actual electron path and the energy, and relations that result from inclusion of the radiation losses. ***W. Kusch.*** *Acta Physica Polonica*, v. 17, no. 5, 1958, p. 295-309.

4563* On the Use of G. M. Counters Filled With a Mixture of $CO_2 + CS_2$ for the Measurement of the Activity of Natural Carbon. I. Discussion of the Techniques Employed in the Measurement of the Activity of Natural Carbon. II. Experiments With G. M. Counters Filled With $Co_2 + CS_2$ Used for Detection of ^{14}C in Natural Carbon. ***W. Mościcki.*** *Acta Physica Polonica*, v. 17, no. 5, 1958, p. 311-343.

4564* Origin of Super Conductivity Conditions of the Atomic Nucleus. Discusses relations between the nucleons in complex nuclei and the similarity to the Fermi-nucleus and metal, and investigates the possibility of an atomic nucleus condition when the latter would be energetically lower than the normal condition. (*In Russian.*) O vozniknovenii sverkhtekuchego sostoianiia atomnogo iadra. ***V. G. Solov'ev.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 4, Dec. 1, 1958, p. 652-654.

4565* Pion-Nucleon Phase Shifts for Intermediate Energies. The pion-nucleon scattering at 150, 170, 220, and 307 Mev is analyzed into S and *P* state phase shifts. The best Fermi type solutions are found, and the statistically plausible ranges of the phase shifts are obtained. ***H. Y. Chiu and E. L. Lomon.*** *Annals of Physics*, v. 6, Jan. 1959, p. 50-69.

4566 1958 Annual International Conference on High Energy Physics at CERN. Papers are grouped and presented in sessions, viz., nucleon structure and reactions, fundamental theories, strange particles, and weak interactions. ***B. Ferretti, editor.*** 358 pp. 1958. CERN, Scientific Information Service, Geneva, Switzerland. (QC173 H53)

4567* A Pulsed Reactor. Scheme of a pulsed reactor working on water and enriched uranium, giving corresponding designs. (*In Russian.*) Migaiushchiĭ reaktor. ***T. N. Zubarev.*** *Atomnaia Energiia*, v. 5, no. 6, Dec. 1958, p. 605-617.

4568 Some Properties of the 2.23-Mev Excited State of P^{31}. The 2.23-Mev excited state of P^{31} has been studied by means of the capture gamma rays from the 1.70-Mev resonance in the reaction $Si^{30}(p\gamma)P^{31}$. The angular correlation of the ground state gamma ray established that the resonance had total angular momentum 3/2, and triple correlation measurements of the cascading gamma rays from the compound state showed that the angular momentum of the 2.23-Mev state was 5/2. Coincidence measurements showed that the cascade gamma rays from the 2.23-Mev state to the first excited state at 1.27-Mev were $\leq 3\%$ of the transitions to the ground state. ***A. E. Litherland, E. B. Paul, G. A. Bartholomew, and H. E. Gove.*** *Canadian Journal of Physics*, v. 37, Jan. 1959, p. 53-62.

4569 High Temperature. Design study for a Canadian high-temperature ceramic-fuel gas-cooled reactor. Fuel elements for high temperature operation. *Engineering*, v. 186, Dec. 26, 1958, p. 829-830.

4570 Investigations of (γ, *pn*)- and (γ, *d*)-Reactions With Gamma Energies up to 32 MeV. The cross section-vs. photon energy relationship was measured for the reactions $Ca^{40}(\gamma, pn)K^{38}$ and $Zn^{66}(\gamma, pn)Cu^{64}$. The integrated cross section of the Zn^{66} (γ, *nn*) Zn^{64} process is about double that of the γ, pn) + (γ, d)-reaction on Zn^{66}. ($\sigma Zn^{66}(\gamma, pn) + Zn^{66}(\gamma, d) = 0.031 \pm 0.008$ MeV barn). The value for the $Zn^{66}(\gamma, nn)$-reaction is calculated from statistical theory to be $\sigma\ Zn^{66}(\gamma, nn) = 0.088$ MeV barn. (*In German.*) Untersuchungen von γ, *pn*)- und (γ, *d*)-Reaktionen mit Gammaenergien bis zu 32 MeV. ***A. Hofmann and P. Stoll.*** *Helvetica Physica Acta*, v. 31, no. 6, 1958, p. 591-600.

4571 Proceedings of the Sixth Scintillation Counter Symposium, January 27-28, 1958, Washington, D. C. Presents the 33 papers given at the meeting. *IRE Transactions on Nuclear Science*, v. NS-5, no. 3, Dec. 1958, p. 76-221. (TK1 In6.6ns Vis.)

4572* Atomic Clocks. Describes the N.P.L. cesium standard and other types of atomic clock. ***Louis Essen.*** *Institution of Electrical Engineers, Journal*, v. 4, no. 48, Dec. 1958, p. 647-653.

4573* Advanced Reactors. III. Homogeneous Systems and Fuel Cycles. Considers homogeneous reactors, examines the influence of fuel cycles on advanced-reactor development, and offers some thoughts on small reactors for ships and other purposes. ***J. V. Dunworth.*** *Institution of Electrical Engineers, Journal*, v. 4, no. 48, Dec. 1958, p. 654-659.

4574* A Survey of Chemical Dosimetric Systems. Covers the literature published on chemical dosimetry for electrons, γ- and X-rays, during the past ten years. A brief discussion of ionization chamber measurements is given as well as the most recent values of *W* for various gases. The dosimeters listed include liquid, solid and gaseous systems with brief comments concerning each. ***Jerome Weiss.*** *International Journal of Applied Radiation and Isotopes*, v. 4, nos. 1/2, Dec. 1958, p. 89-95.

4575* Contribution to the Study of the Preparation of Caesium Sources. Studies the importance of volatilization when fusion is used for preparing sources of the two most interesting salts: cesium chloride and cesium sulfate. Cesium sulfate is more volatile than the chloride. ***J. Trocker, C. Fisher, and A. Raggenbass.*** *International Journal of Applied Radiation and Isotopes*, v. 4, nos. 1/2, Dec. 1958, p. 96-107.

4576 Introduction to Nuclear Engineering. Emphasizes topics which differ from standard engineering practice, particularly those topics unique to the field of nuclear engineering. ***Richard Stephenson.*** 2nd Ed. 491 pp. 1958. McGraw-Hill Book Co., Inc., New York. (TK9145 St45i2)

4577* Theoretical Study on Transient Responses of Heterogeneous Water-Moderated and Cooled Reactor Due to Certain Accidents. Analytically deals with the reactor's transient responses in various accidents by the use of an electronic analog computor, viz. the response to the sudden change of reactivity in a way of a step function and by a way of a ramp function, the response to the sudden stoppage of the primary coolant pump, and the response to an accident at the starting instant. ***Shigenori Hayashi, Jiro Wakabayashi, and Tetsuo Iwazumi.*** *Kyoto University, Engineering Research Institute, Technical Reports*, v. 8, no. 9, Oct. 1958, 21 pp.

4578 Safe Handling of Isotopes. IAEA Draft Manual Issued. *Nuclear Engineering*, v. 4, Jan. 1959, p. 32-33.

4579* 60° Sector Type Electromagnetic Isotope Separator in the Institute of Nuclear Sciences—Belgrade. Ion path radius is 75 cm. The ion source of magnetic type with oscillating electrons is used. ***I. F. Ševarac, B. Dj. Perović, B. V. Dunjić, and R. M. Protić.*** *Nuclear Instruments*, v. 3, no. 5, Nov. 1958, p. 245-249.

4580 Nuclear Reactor Metallurgy. A description and qualitative treatment written to give every engineer and scientist a clear introduction to this new field. Describes U, and its ores, production, alloys, metallography, thermal properties, fabrication, corrosion, and radiation effects. A discussion of the special problems presented by Pu, Th, Be, and Zr follows. Other specialized areas are also examined. ***Walter D. Wilkinson and William F. Murphy.*** 382 pp. 1958. D. Van Nostrand Co. Princeton, New Jersey. (TK9202 W65n)

4581 The Army Reactor Program. Describes, with the cooperation of the Army Reactors Branch of the AEC, the over-all Army reactor program, the Army package power reactors, and the gas-cooled reactor program. Includes a foldout description of the latest Army reactor to go critical—the Argonne Low Power Reactor. *Nucleonics*, v. 17, Feb. 1959, p. 46-60.

4582 Physical Simulation of a Variable-Reflector Reactor. A scheme for controlling a boiling-water reactor uses the steam pressure in the reactor pressure vessel to vary the height of the water reflector surrounding the core. As the steam pressure increases, the reflector height decreases. Thus, as the steam load

varies, the reactor power level follows the load changes. By means of combined hydraulic and electronic simulation, the positioning of baffle plates in hydraulic coupling is shown to give the desired control. ***J. J. Stone, Jr., B. B. Gordon, and R. S. Boyd.*** *Nucleonics*, v. 17, Feb. 1959, p. 93-96.

4583 Flexible Cobalt Facility Will Hold Up to 10^6 Curies. The new irradiation facility at Southwest Research Institute. *Nucleonics*, v. 17, Feb. 1959, p. 102-103.

4584 Recoil Effect in Beta Decay and K Capture. The study of recoil effects is extended to the case of forbidden transitions. Presents formulas for the angular distribution of recoil nuclei from oriented parent nuclei, the polarization of the recoil nucleus, and the angular correlation between the recoil nucleus and the following γ ray. ***Claude C. Bouchiat.*** *Physical Review*, v. 112, ser. 2, no. 3, Nov. 1, 1958, p. 877-889.

4585 Neutron Emission Following μ-Meson Capture in Silver and Lead. The above measured by use of a high-efficiency Cd-loaded liquid-scintillator tank. ***Selig N. Kaplan, Burton J. Moyer, and Robert V. Pyle.*** *Physical Review*, v. 112, ser. 2, no. 3, Nov. 1, 1958, p. 968-978.

4586 Study of Some (p, n) Reactions by Neutron Time of Flight. A millimicrosecond time-of-flight technique has been applied to the study of (p, n) reactions in K, Ca^{48}, Ti, Cr, Mn, Fe, Cu, As, and Rb using the phase-focused 3-Mev proton beam from a small fixed-frequency cyclotron. ***A. J. Elwyn, H. H. Landon, Sophie Oleksa, and G. N. Glasoe.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1200-1209.

4587 Semiclassical Treatment of Direct Nuclear Reactions. Above is employed to discuss the angular distributions reactions. The method considers the incident and outgoing particles to be described by rays which follow classical paths; these rays can be refracted, reflected, and absorbed by a "clouded-crystal-ball" nucleus. ***S. T. Butler, N. Austern, and C. Pearson.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1227-1238.

4588 Determination of the Pion-Nucleon Scattering Amplitude From Dispersion Relations and Unitarity. General Theory. A method is proposed for using relativistic dispersion relations, together with unitarity, to determine the pion-nucleon scattering amplitude. The usual dispersion relations by themselves are not sufficient, and we have to assume a representation which exhibits the analytic properties of the scattering amplitude as function of the energy and the momentum transfer. ***S. Mandelstam.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1344-1360.

4589 Power Reactor Technology. The various areas of reactor development from the general viewpoint of the reactor designer rather than from the more detailed points of view of specialists in the individual areas. However, papers of particular significance or usefulness in specialized fields will be mentioned. *Power Reactor Technology*, v. 2, no. 1, Dec. 1958, 37 pp.

4590* The Dispersion Relation and the Pion-Nucleon Interaction Cross Section at Very High Energies. Total cross sections for the π^+-p and π^--p interactions are evaluated under the assumption that the cross sections are constants above a certain very high energy. ***Tetsuro Sakuma, Shinya Furui, and Akira Kanazawa.*** *Progress of Theoretical Physics*, v. 20, no. 6, Dec. 1958, p. 835-843.

4591* Meson Production in Meson-Nucleon Interaction. The meson production by mesons in the low-energy limit has been re-examined in the frame of static model of the extended source theory. Using Feynman's technique, the calculation has been performed up to fifth order in the coupling constant. ***S. K. Kundu.*** *Progress of Theoretical Physics*, v. 20, no. 6, Dec. 1958, p. 939-947.

4592 Radioisotopes in Scientific Research. v. I. Research With Radioisotopes in Physics and Industry. v. II. Research With Radioisotopes in Chemistry and Geology. Proceedings of the International Conference held in Paris in September, 1957, under the auspices of the United Nations Educational Scientific and Cultural Organization, consisting of more than 200 papers. ***R. C. Extermann, editor.*** 761 and 741 pp. 1958. Pergamon Press, New York. (QC770 In7.9p)

4594 Nuclear Propulsion. The economics of nuclear power **search With Special Reference to the Results of Some Recent Steelworks Trials.** ***D. H. Houseman.*** *Refractories Journal*, v. 34, Dec. 1958, p. 540-546.

4594 Nuclear Propusion. The economics of nuclear power for ship propulsion and the types of reactor systems which could best be used for mobile reactors are presented. Points out that mobile reactors present difficult shielding problems as weight must usually be kept at a minimum. ***J. Edwards.*** *Research*, v. 12, Jan. 1959, p. 26-35.

4595 Nuclear Energetics. A study of the principles of design of nuclear reactors intended for the production of industrial power as well as of the operational characteristics of nuclear power plants. Particular emphasis is given to materials for nuclear reactors. ***D. I. Voskoboinik.*** *U. S. Atomic Energy Commission, AEC-tr-3437*, 1956, 130 pp. (UF767 Un3.1ae Contin.)

4596 Energetics of Nuclear Reactors. Principles of several atomic power stations are discussed. ***A. K. Krasin.*** *U. S. Atomic Energy Commission, AEC-tr-3438*, 1957, 40 pp. (UF767 Un3.1ae Contin).

4597 Reactor Fuse Propellants and Configurations. Compressed gas, explosive gases, and solid chemical propellants are discussed; the latter proved to be the best. A symmetrical annular fuse configuration was found to be best when compared with other styles. ***R. J. Spera, S. N. Stilwell, and W. Lamond Weiss.*** *U. S. Atomic Energy Commission, APEX-388*, Dec. 1956, 33 pp. (UF767 Un3.1ap Contin.)

4598 Shielding Computer Program 11-0, Reactor Shield Analysis. Program 11-0 uses the Albert-Welton point kernel to compute the fast neutron dose rates in an infinite hydrogenous medium from a point isotropic fission source. ***K. B. Hanchon.*** *U. S. Atomic Energy Commission, APEX-433*, Nov. 1958, 10 pp. (UF767 Un3.1ap Contin.)

4599 Test Data From the 2π Solid-Angle Shield-Cover Experiment. These tests were conducted to provide basic air- and ground-scattering data, as well as to determine the minimum requirements for facilities needed to develop a nuclear aircraft shield. ***R. H. Clark, et al.*** *U. S. Atomic Energy Commission, APEX-439*, Dec. 19, 1958, 246 pp. (UF767 Un3.1ap Contin.)

4600 Progress Relating to Civilian Applications During November, 1958. Report discusses numerous phases of civilian application of atomic energy including developments for zirconium-clad fuel elements, developments for aluminum-clad fuel elements, radioisotope and radiation applications, processing of feed materials, developments for LMFRE, research for AEC reactor development division program, reactor materials and components, studies of alloy fuels, general fuel-element development, fatigue studies of Inconel and INOR-8, and physical research. ***Russell W. Dayton and Clyde R. Tipton, Jr.*** *U. S. Atomic Energy Commission, BMI-1304*, Dec. 1, 1958, 64 pp. (UF767 U3b Contin.)

4601 An Addendum to a Parametric Study of the Gas-Cooled Reactor Concept. Provides background information and additional information resulting from the studies made on the gas cooled reactor concept. *U. S. Atomic Energy Commission, HW-54727*, Sections individually paged. (UF767 Un3.1hw Contin.)

4602 Nuclear Physics Research Quarterly Report, April, May, and June, 1958. Covers the fields of theoretical physics, critical mass physics, reactor lattice physics, and experimental nuclear physics. *U. S. Atomic Energy Commission, HW-56919*, July 21, 1958, 78 pp. (UF767 Un3.1hw Contin.)

4603 Plutonium System Study With an Application to the MTR. In order to estimate their effects on reactor behavior, various initial concentrations of Pu^{239}, Pu^{240}, and Pu^{241} have been considered using a simplified approach. ***W. B. Lewis and G. D. Marshall.*** *U. S. Atomic Energy Commission, IDO-16455*, Nov. 20, 1958, 27 pp. (UF767 Un3.1id Contin.)

4604 Reactor Technology Quarterly Report No. 7—Physics. Contains information on a year's progress in the area of physics at the Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission, KAPL-2000-4*, Dec. 1958, 103 pp. (UF767 Un3.1ka Contin.)

4605 Gamma-Ray Dose Rates Resulting From Neutron Captures in Air. A Monte Carlo calculation of the γ-ray fluxes and dose rates was performed assuming a monoenergetic source and both the source and detector to be suspended in an infinite body of air. ***F. L. Keller, C. D. Zerby, and W. W. Dunn.*** *U. S. Atomic Energy Commission, ORNL-2462*, Dec. 31, 1958, 33 pp. (UF767 U3o Contin.)

4606 Cyclotrons and High-Energy Accelerators 1958. In all, 140 cyclotrons and other high-energy accelerators are reported. Verified data are provided for 108 of these. ***F. T. Howard.*** *U. S. Atomic Energy Commission, ORNL-2644*, Nov. 17, 1958, 311 pp. (UF767 U3o Contin.)

4607 Reactor Material Specifications. Welding, inspection, and material specifications are presented. ***R. M. Evans, editor.*** *U. S. Atomic Energy Commission, TID-7017*, Oct. 29, 1958, 246 pp. (UF767 Un3ti Contin.)

4608 Controlled Thermonuclear Conference Held at Washington, D. C., Feb. 3-5, 1958. This report is a compilation of 85 papers presented at a conference on controlled thermonuclear reactions. The conference was attended by AEC personnel, personnel of AEC contractors, representatives of other agencies of the United States Government, and representatives of the United Kingdom Atomic Energy Authority. *U. S. Atomic Energy Commission, TID-7558*, Oct. 1958, 528 pp. (UF767 Un3ti Contin.)

4609 Hyperfine-Structure Measurements on Some Transuranic Elements. Measurements by the atomic beam flop-in method have yielded values of J and g_J of the low-lying electronic states of each element and values for the nuclear spin of each isotope. ***Richard Marrus.*** *U. S. Atomic Energy Commission, UCRL-8547*, Nov. 23, 1958, 93 pp. (UF767 U3u Contin.)

4610* Coulomb Excitation of High Energy Nuclear Levels in Even Isotopes of Tungsten. Natural tungsten and samples of tungsten enriched with isotopes of W^{182}, W^{184} and W^{186} were irradiated with 8.3 to 14.5 MeV α-particles. (*In Russian.*) Kulonovskoe vozbuzhdenie iadernykh urovneĭ s bol'shoĭ energieĭ v chetnykh izotopakh vol'frama. ***D. G. Alkhazov, et al.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 35, no. 6, Dec. 1958, p. 1325-1334.

See also: **4144** (nuclear power costs); **4306** (nuclear rocket propulsion); **4338** (liquid Na and Bi fuel systems); **4352** (bearing lubrication in nuclear power station); **4644** (solvent extraction recovery of U).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

4611 How to Create and Maintain a Manual to Keep Good Systems Intact. IV. ***Walter S. Athearn.*** *American Business*, v. 29, Jan. 1959, p. 28-31.

4612 Operational Research and the Chemical Industry. ***K. Pennycuick.*** *Chemistry & Industry*, 1959, no. 1, Jan. 3, p. 13-17.

4613* Institutional Administration. Reiterates the point that organizations consist of interacting people, set in an environment which must sustain their cooperative effort, and that legal authority and autonomous position are an insufficient base for the management of any organization. ***Phillip Monypenny.*** *Library Trends*, v. 7, Jan. 1959, p. 337-345.

4614 How to Organize an Effective Engineering Training Program. ***Richard E. Hoppe.*** *Machine Design*, v. 31, Feb. 5, 1959, p. 94-98.

4615* A Model for Personnel Recruiting and Selection. Presents a mathematical model for determining a minimum cost strategy for the personnel recruiting and selection situation. A quota is set for the minimum number of good employees to be added each period, and selection is done on the basis of a test having a known correlation with the given criterion of job success. ***Richard C. Kao and Thomas C. Rowan.*** *Management Science*, v. 5, no. 2, Jan. 1959, p. 192-203.

4616 Mathematical Programming. Uses a practical approach, citing examples from everyday management problems to illustrate the methods. ***Nyles V. Reinfeld and William R. Vogel.*** 274 pp. 1958. Prentice-Hall, Englewood Cliffs, N. J. (QA264 R27m)

4617 Operations Research in a Metal Rolling Mill. Describes in detail the application of O-R methods to problems of a copper-rolling mill. ***A. P. M. Purdon.*** *Metal Treatment and Drop Forging*, v. 25, Dec. 1958, p. 503-507.

4618* Technical and Human Aspects of Research and Development. A study of the relationship of an organization devoted to research with an industry primarily devoted to production, as viewed by the director of the Instituto Siderurgico Finsider. ***Antonio Scortecci.*** *Metal Treatment and Drop Forging*, v. 26, Jan. 1959, p. 3-6.

4619* An Operations Research Approach to Mine Haulage. II. Examples cited show how operations research can aid in the understanding and solution of mining problems. While the analyst may deal with abstract mathematics, the numbers he manipulates represent the essentials of very real problems of industry. ***Ernest Koenigsberg.*** *Mining Congress Journal*, v. 45, Jan. 1959, p. 53-56.

4620* Seven Steps to Cost Control. The steps are planning work, correct placement, job training, building teamwork, maintenance control, equipment replacement, and employee's ideas. ***George S. Odiorne.*** *Paint Industry Magazine*, v. 74, Jan. 1959, p. 21-22.

ORE AND MATERIALS BENEFICIATION

4621* The Effects of Mono- and Dibutyl Phosphates on the Tributyl Phosphate Extraction of Pu. Determination of the distribution coefficients of mono- and dibutyl phosphates between the organic phase and water, and acid, alkali and carbonate solutions. Concentrations of mono- and dibutyl phosphate below 0.001 and 0.0001 mole/l, respectively, hardly affect the extraction of Pu by tributyl phosphate. (*In Russian.*) Vliianie mono- i dibutilfosfatov na ekstraktsiiu plutoniia tributilfosfatom. ***V. B. Shevchenko and V. S. Smelov.*** *Atomnaia Energiia*, v. 5, no. 5, Nov. 1958, p. 542-545.

4622 New Methods of Studying the Sintering Process. The most important characteristic of a sintering charge of ore is its gas permeability both before and during sintering. A simple apparatus for determining the gas permeability of routine production and experimental charges. ***V. S. Abramov.*** *Henry Brutcher Translation No.* 4385, 15 pp. (From *Stal'*, v. 17, no. 3, 1957, p. 195-199.) Henry Brutcher, Altadena, Calif.

4623 The Leaching of Manganese From Pyrolusite Ore by Pyrite. A new method of leaching low-grade Mn ore ($< 5\%$ Mn) utilizing pyrite as a reagent. ***G. Thomas and B. J. P. Whalley.*** *Canada, Mines Branch, Research Report*, R-3, Feb. 1958, 7 pp. (TN26 C16.5r Contin.)

4624 Liquid-Solid Separation Factors in Hydrometallurgical Leach Circuit Design. Countercurrent decantation and filtration with cake washing. Influence of particle size distribution, temperature, pH, flocculation, repulping, solids concentration, and filter cake permeability. ***R. C. Emmett and D. A. Dahlstrom.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 3-8.

4625* Tungsten. Extraction, physical and chemical properties, important uses. ***L. Sanderson.*** *Canadian Mining Journal*, v. 80, Jan. 1959, p. 71-73.

4626* Possibility of Reducing the Cost and Accelerating the Industrial Survey of Gas Fields by Experimental Exploitation. (*In Russian.*) Vozmozhnosti udeshevleniia i uskoreniia promyshlennoĭ razvedki gazovykh mestorozhdeniĭ putem ikh opytnoĭ ekspluatatsii. ***A. L. Kozlov, V. P. Savchenko, and N. V. Cherskii.*** *Gazovaia Promyshlennost'*, 1959, no. 1, Jan., p. 4-10.

4627 Materials of Construction for Head-End Processes. Aqueous Reprocessing of Nuclear Fuels. Laboratory studies of gas- and liquid-phase reactions show that Ta, Ti, Mo, Ni, the Hastelloys, Inconel, Haynes 25, Type S-816, and Illium R are promising materials of construction, depending on the route chosen for the Zircex process. Unalloyed Ti may fill all construction requirements in the Darex process. ***Charles L. Peterson, Paul D. Miller, Earl L. White, and Walter E. Clark.*** *Industrial and Engineering Chemistry*, v. 51, Jan. 1959, p. 32-37.

4628 Trialkyl Phosphates and Dialkyl Alkylphosphonates in Uranium and Thorium Extraction. Most of the reported work with the tertiary esters of phosphorus compounds as extractants for actinides has been done with tri-*n*-butyl phosphate. Improved selectivity against the extraction of Zr was obtained when any of a variety of groups was substituted for the butoxy group. ***T. H. Siddall, III.*** *Industrial and Engineering Chemistry*, v. 51, Jan. 1959, p. 41-44.

4629 Recovery and Purification of Plutonium by Anion Exchange. The formation of anionic nitrate complexes by Pu(IV) is utilized for separation, purification, and concentration by anion exchange in small, inexpensive process equipment. ***J. L. Ryan and E. J. Wheelwright.*** *Industrial and Engineering Chemistry*, v. 51, Jan. 1959, p. 60-65.

4630 The Recovery of Molybdenum From Acid Solution Using Potassium Ferrocyanide. Simple process by which Mo can be recovered in 65-70% yield from a solution containing a high concentration of sulphuric and nitric acids following its precipitation as a complex by reaction with potassium ferrocyanide. Investigation of the composition of the precipitated complex for which the formula $(MoO_2)_3[Fe(CN)_6]_2$ is proposed. ***D. Robbins.*** *Journal of Applied Chemistry*, v. 8, Dec. 1958, p. 777-781.

4631 Defining Uranium Concentrate Specifications. ***J. R. Nelli, W. C. Manser, and D. S. Arnold.*** *Journal of Metals*, v. 11, Jan. 1959, p. 33-35.

4632* The Possibility of Sintering of Fine Ore Powders and Muds in Sinterworks. (*In Hungarian.*) Finom ércporok és iszapok zsugorítási lehetősége szívással dolgozó darabosító üzemekben. ***Lászlõ Visnyovszky and Tiborné Hollõ.*** *Kohászati Lapok*, v. 91, nos. 10-11, Nov. 1958, p. 477-481.

4633* Recent Advances in Coal Thermal Drying. ***F. R. Zachar.*** *Mining Congress Journal*, v. 45, Jan. 1959, p. 32-36.

4634* Drilling and Blasting Taconite. Combined techniques of the use of the jet piercer drill, careful choice of blasting pattern and strict attention to loading of explosives. ***Floyd W. Erickson.*** *Mining Congress Journal*, v. 45, Jan. 1959, p. 37 + 3 pages.

4635* Texas-Zinc Minerals Project. Bird's-eye view of the Texas-Zinc 800 ton U mill in Utah. ***Neill K. Banks.*** *Mining Congress Journal*, v. 45, Jan. 1959, p. 44-47.

4636 Advances in Magnetic Separation of Ores. A review of the problem. Discusses flow-sheets and description of the separation features of some Canadian plants. ***L. A. Roe.*** *Mining Engineering*, v. 10, Dec. 1958, p. 1261-1265.

4637 Magnetic Separation for Mesabi Magnetite Taconite. General characteristics, control, separator design and performance. ***J. E. Forciea, L. G. Hendrickson, and O. E. Palasvirta.*** *Mining Engineering*, v. 10, Dec. 1958, p. 1269-1276.

4638* Ray Mines Closes Ore to Metal Cycle. Kennecott Ray Division completes LPF plant and new smelter. *Mining World*, v. 21, no. 1, Jan. 1959, p. 44-46.

4639* Main Directions in the Development of Technological Tables of Genealogy Showing Pretreatment of Ore for Preparation. Main directions—optimum grain size of crushed product—industrial utilization of technological tables of genealogy for pretreatment of ore. (*In German.*) Hauptrichtungen in der Entwicklung technologischer Stammbäume für die Vorbehandlung des Erzes zur Aufbereitung. ***W. K. Zachwatkin.*** *Neue Hütte*, v. 3, Nov. 1958, p. 643-650.

4640* Results of Calamine Ore Flotation. Flotation tests of calamine ores from "Orzel Bialy" mine carried out for recovering smithsonite using hexadecylamine as the main flotation reagent. (*In Polish.*) Dotychczasowe wyniki flotacyjnego wzbogacania rud galmanowych. ***J. Adamiczka and A. Molicka-Haniawetz.*** *Prace Instytutów Hutniczych* 1958, no. 10, p. 269-275.

4641* Washing Fine Coal by Means of Cyclones. From Laboratory to Practice. Continuous industrial operation with continuous regeneration of the dense medium. Horizontal cyclones give better separation whilst reducing the height of charge to 14 ft. 9 in. De-watering and rinsing with the curved sieve. Consumption reduced to 1.32 lb. per ton. Less wear of the screening surfaces and lower magnetite losses result. (*In French.*) Le lavage des fines par cyclone. Du laboratoire à la pratique. ***S. de Chawlowski.*** *Revue de l'Industrie Minérale*, v. 40, no. 12, Dec. 1958, p. 925-936.

4642* Recent Trends in Ore Dressing at Løkken. II. The Plant. A smelting process for production of elemental S and Cu matte is replaced by a Sink-Float installation. (*In Norwegian.*) Nyere trekk ved oppredningen på Løkken. II. Anlegg. ***H. Lund-Andersen.*** *Tidsskrift for Kjemi, Bergvesen og Metallurgi*, v. 18, no. 8, 1958, p. 131-138.

4643 The Adaptation of New Research Techniques to Mineral Engineering Problems. Collection of articles covering research in mineral progress. *U. S. Atomic Energy Commission, NYO-2293*, Oct. 31, 1958, 45 pp. (UF767 U3ny Contin.)

4644 The Recovery of Uranium From Sulfate Solutions by Solvent Extraction With Tributyl Phosphate. Supporting laboratory data and a process chemical flowsheet are given for the recovery of U with tributyl phosphate. ***J. R. Flanary and J. H. Goode.*** *U. S. Atomic Energy Commission, ORNL-2615*, Dec. 3, 1958, 15 pp. (UF767 U3o Contin.)

PHYSICS

4645 Ultrasonic Absorption and Thermal Relaxation in CO_2. Measurements were made in dry CO_2, and in CO_2 with hydrogen admixtures, between 19 C and 146 C and at pressures from 0.1 to 650 atmos, and frequencies from 300 kc to 7 Mc. ***M. C. Henderson and J. Z. Klose.*** *Acoustical Society of America, Journal*, v. 31, Jan. 1959, p. 29-33.

4646 Diffraction of Light by Ultrasonic Waves Progressing With Finite but Moderate Amplitudes in Liquids. The above is used to detect and measure the finite amplitude distortion in water and CCl_4. Develops a theory relating the distortion present to available isothermal compressibility measurements. ***K. L. Zankel and E. A. Hiedemann.*** *Acoustical Society of America, Journal*, v. 31, Jan. 1959, p. 44-54.

4647* Electrical Discharges in High Vacuum. Measurements show that the mechanism of a breakdown in high vacuum is identical with the events observed at very low voltages making it possible to form a uniform picture by which many already well-known phenomena can be explained. ***G. Schmidt.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 9, nos. 1-2, 1958, p. 1-12.

4648* On the Crystal Structure of $AlCl_3$. Structure has been derived on the basis of crystal-geometrical considerations starting from the dimension of the unit cell and from the fact that in the crystal lattice, according to electric conductivity measurement, there should be ionic bonds. ***K. Sasvári.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 9, nos. 1-2, 1958, p. 195-202.

4649* Some Problems of Growth, Structure and Properties of Semiconductor Monocrystals. (*In Russian.*) Nekotorye voprosy, otnosiashchiesia k vyrashchivaniiu monokristallov poluprovodnikov, ikh strukture i svoĭstvam. ***D. A. Petrov.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 9, nos. 1-2, 1958, p. 217-227.

4650* High Temperature Surging Light Source. Experimental results with a modified capillary device, and the measurement data. (*In Russian.*) Vysokotemperaturnyĭ impul'snyĭ istochnik sveta. ***A. A. Mak.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 4, Dec. 1, 1958, p. 671-672.

4651* Absolute Electron-Nuclear Differential Scattering Cross Sections at 1.00 Mev, 1.75 Mev, and 2.50 Mev. I. The discrepancy between the corrected Mott theory and the measured cross sections is well outside the experimental error for monoergic electrons scattered from thin foils of Al, Ni, Ag, and Au. ***V. Spiegel, Jr., T. F. Ruane, D. J. Anthony, B. Waldman, and W. C. Miller.*** *Annals of Physics*, v. 6, Jan. 1959, p. 70-85.

4652* Plural Scattering of Electrons at 1.00 Mev, 1.75 Mev, and 2.50 Mev. II. The data presented show the onset of plural scattering and may be used as a convenient guide for single scattering. ***V. Spiegel, Jr., W. C. Miller, and B. Waldman.*** *Annals of Physics*, v. 6, Jan. 1959, p. 86-89.

4653* Absolute Electron-Electron Differential Scattering Cross Sections at 1.00 Mev, 1.50 Mev, and 2.00 Mev. III. Monoergic electrons were scattered from thin Zapon and Nylon foils. The absolute electron-electron scattering cross sections agree with the theory of Moller to within the experimental error of 4%. ***J. J. Kepes, B. Waldman, and W. C. Miller.*** *Annals of Physics*, v. 6, Jan. 1959, p. 90-101.

4654* A Generalized Theory of Sedimentation. A theoretical relationship between the concentration and the sedimentation velocity of non-flocculated suspensions of particles is derived. It is shown that the settling velocity relative to that of a single particle in the suspension is $(1-c)\beta$ where β is a function of particle shape, size distribution and Reynolds number and c is the volume of solid per unit volume of suspension. The expression is shown to satisfy the experimental results of other workers. An empirical relationship between β and the Reynolds number is suggested. ***A. D. Maude and R. L. Whitmore.*** *British Journal of Applied Physics*, v. 9, Dec. 1958, p. 477-482.

4655 Note on the Motion of Electrons and Holes in Perturbed Lattices. A new set of orthogonal, localized functions is discussed. The functions bear the same relation to the functions of Luttinger and Kohn as the Wannier functions bear to the Bloch functions. The new functions are used to give an alternative derivation of the effective mass equation. ***R. R. Haering.*** *Canadian Journal of Physics*, v. 37, Jan. 1959, p. 47-52.

4656* Variation of the Volume of the Electron Localization and Shock Displacement in Electronic Transitions. Effect of the expansion of the electronic orbitals of an atom subjected to impacts during an electronic transition. A simple model was proposed having a radius connected wtih the number of impacts, thus with density. The displacement was discussed. (*In French.*) Variation du volume de localisation des électrons et déplacement par choc dans les transitions électroniques. ***Frédéric Schuller and René Bergeon.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 247, no. 23, Dec. 10, 1958, p. 2113-2116.

4657 Elasticity and Plasticity. Objective is to draw attention to significant recent developments in the mathematical theories of elasticity and plasticity, concentrating on the modern trends in analysis. Emphasis is on contributions made by Russian authors and others whose work is not yet fully integrated into the western literature. ***J. N. Goodier and P. G. Hodge, Jr.*** 152 pp. 1958. John Wiley & Sons, New York. (QA931 G61e)

4658* Hall Effect in Semiconductor Compounds. Modern applications using indium arsenide and indium antimonide. ***M. J. O. Strutt.*** *Electronic & Radio Engineer*, v. 36, Jan. 1959, p. 2-10.

4659 Dependence of the Saturation Charge of Po-α-Particles on Pressure, in CO_2, A-CO_2- and A-CH_4 Mixtures. These gas mixtures show a dependence of the saturation charge of Po-α-particles on pressure when the dependence of the mobility of electrons on field strength is neglected. (*In German.*) Druckabhängigkeit der Sättigungsladung von Po-α-Teilchen in CO_2, A-CO_2- und A-CH_4-Mischungen. ***F. Widder and P. Huber.*** *Helvetica Physica Acta*, v. 31, no. 6, 1958, p. 601-624.

4660 Magnetic Amplifiers. Theory and Application. Summarizes the history and development of the magnetic amplifier. Basic magnetic theory is discussed rather briefly; the operation of the saturable reactor and the magnetic amplifier is described in full detail and scores of industrial and commercial applications are presented. ***Sidney Platt.*** 238 pp. 1958. Prentice-Hall, Englewood Cliffs, N. J. (TK2851 P69m)

4661* Gravitational Properties of Antimatter. Concludes that all particles and antiparticles probably have positive inertial and passive gravitational masses and that the equivalence principle is valid to at least very great accuracy. ***L. I. Schiff.*** *National Academy of Sciences, Proceedings*, v. 45, Jan. 1959, p. 69-80.

4662* Electronic Apparatus for the Measurement of Dynamic Magnetic Fields. Apparatus reproduces with a staircase voltage waveform a magnetic field rising between 0 and about 120 gauss. ***I. F. Quercia.*** *Nuclear Instruments*, v. 3, no. 5, Nov. 1958, p. 292-297.

4663 Scattering and Absorption of Electromagnetic Radiation by Infinite Cylinders. Expressions suitable for machine computation are presented for the above properties of infinitely long, dielectric, and conducting cylinders. ***Bert K. Larkin and Stuart W. Churchill.*** *Optical Society of America, Journal*, v. 49, Feb. 1959, p. 188-190.

4664 Electrons in Polar Crystals. A model study. The method is valid only in cases where the tight-binding approach is appropriate even when the effects due to the lattice displacements are ignored. ***G. L. Sewell.*** *Philosophical Magazine*, v. 3, ser. 8, Dec. 1958, p. 1361-1380.

4665 The Interpretation of Soft X-Ray Emission Spectra. Results from a study of the K satellite emission bands observed in lithium and beryllium. ***J. A. Catterall and J. Trotter.*** *Philosophical Magazine*, v. 3, ser. 8, Dec. 1958, p. 1424-1431.

4666 Theory of the Hall Effect in Ferromagnetic Substances. Theory is computed on the basis of a simple model. The calculation is rigorous, but assumes a slowly varying scattering potential, a simple band, and very few conduction electrons which are not very realistic. ***J. M. Luttinger.*** *Physical Review*, v. 112, ser. 2, no. 3, Nov. 1, 1958, p. 739-751.

4667 Electron Self-Energy Approach to Correlation in a Degenerate Electron Gas. ***John J. Quinn and Richard A. Ferrell.*** *Physical Review*, v. 112, ser. 2, no. 3, Nov. 1, 1958, p. 812-827.

4668 Perturbation Theory for an Infinite Medium of Fermions. Shows that the entire structure of the theory may be carried over to the case of finite temperature, requiring only a redefinition of the Green's functions. ***Abraham Klein and Richard Prange.*** *Physical Review*, v. 112, ser. 2, no. 3, Nov. 1, 1958, p. 994-1007.

4669 Atomic Force Constants of Copper From Feynman's Theorem. The first- through third-neighbor force constants in the copper crystal are found as the components of the change in force produced on the nuclei when in equilibrium positions by the infinitesimal unit displacements of one nucleus. ***Harrison C. White.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1092-1105.

4670 Electron Spin Resonance of Atomic and Molecular Free Radicals Trapped at Liquid Helium Temperature. Resonance spectra of trapped H, D, N, and CH_3 have been observed and interpreted. The effect of the matrix field on the resonance properties of the radicals has been investigated by depositing the radicals in matrices with different binding energies. The effect of the matrix on the g factor is extremely small in all cases. ***C. K. Jen, S. N. Foner, E. L. Cochran, and V. A. Bowers.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1169-1182.

4671 New Techniques in the Lamb Shift Calculation. Based on the analogy between the calculations of radiative corrections to electron scattering and the Lamb shift, a new procedure applicable to bound state self-energy problems is developed, wherein the electron propagator is expanded in powers of the external potential. ***H. M. Fried and D. R. Yennie.*** *Physical Review*, v. 112, ser. 2, no. 4, Nov. 15, 1958, p. 1391-1404.

4672 Complete Absorption of Light by Thin Metal Films. For the p-polarization there is a maximum reflectance near the

critical angle for the substrate; for a certain range of Al thicknesses this is followed by a sudden drop which can be to zero reflectance giving complete absorption. ***T. Turbadar.*** *Physical Society, Proceedings*, v. 73, pt. 1, Jan. 1959, p. 40-44.

4673* **On the Observation of Magnetic Poles.** An efficient method for detecting the presence of even one magnetic pole among thousands of tons of magnetic minerals is proposed. This method is sensitive enough to detect such a small amount of magnetic pole as has escaped from the whole cosmic ray observations so far conducted. ***Eiichi Goto.*** *Physical Society of Japan, Journal*, v. 13, Dec. 1958, p. 1413-1418.

4674* **Theory of Excited Plasma Waves.** The excitation of oscillations in a uniform plasma by an injected electron beam is considered. The solutions of the dispersion relation are obtained which yield the characteristics of excited waves; the frequency, the phase velocity and the time-rate of wave-growth as functions of the wave number. ***Masao Sumi.*** *Physical Society of Japan, Journal*, v. 13, Dec. 1958, p. 1476-1485.

4675* **On the Theory of Fluids.** The "netted ring approximation" is proposed. Several thermodynamic properties are derived by means of this approximation. ***Kazuo Hiroike.*** *Physical Society of Japan, Journal*, v. 13, Dec. 1958, p. 1497-1503.

4676 **Magnetic Resonance of the Solid State.** Impurity atoms, trapped electrons and holes, vacancies, interstitial atoms, dislocations and strains, and excited states were discussed. ***D. J. E. Ingram.*** *Physics Today*, v. 12, Jan. 1959, p. 22-24.

4677 **C^{12} as a Basis for a Unified Scale of Nuclidic Masses and Atomic Weights.** ***T. P. Kohman, J. H. E. Mattauch, and A. H. Wapstra.*** *Physics Today*, v. 12, Jan. 1959, p. 30 + 1 page.

4678* **Magnetic Properties of the Iron-Group Anhydrous Chlorides.** The spin-orbit coupling energy produces a splitting of the spin levels belonging to the lowest doublet. In the vicinity of, or below, the Néel temperature (24 K) where only the lowest spin level is populated, we have effectively an Ising model, in which the x, y components of the spins are completely quenched. ***Junjiro Kanamori.*** *Progress of Theoretical Physics*, v. 20, no. 6, Dec. 1958, p. 890-908.

4679* **On Quantum Theory of Transport Phenomena.** The basic equation obtained has a form similar to Bloch's kinetic equation and reduces to the latter in the limit of a system of weakly interacting particles. It is found that the Einstein relation is valid only for the symmetric part of diffusion- and electric conductivity tensors, in agreement with Kasuya's suggestion. ***Sadao Nakajima.*** *Progress of Theoretical Physics*, v. 20, no. 6, Dec. 1958, p. 948-959.

4680 **Quantum Particle Dynamics.** Objective is to provide an up-to-date book of convenient size that will enable those having no previous acquaintance with relativity or quantum theory to acquire sufficient knowledge of quantum mechanics, quantum electrodynamics and meson theory to understand the main features of the theory of elementary particles. ***J. McConnell.*** 252 pp. 1958. Interscience, New York. (QC174 M13q)

4681 **Auger Effect in Semiconductors.** A calculation of the lifetimes of excess electrons and holes in a semiconductor assuming the Auger effect between bands to be the only recombination mechanism. ***A. R. Beattie and P. T. Landsberg.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 1, 1959, p. 16-29.

4682 **Reactions of Metastable Atoms and Resonance Photons.** Total collision cross-sections of He 2 ^3S and Ne ^3P atoms and their resonance photons with He, Ne, A at thermal energies are described. The yields for the resonance photons have also been determined. ***J. B. Hasted and P. Mahadevan.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 1, 1959, p. 42-50.

4683 **Experiments on the Instability of a Layer of Mercury Heated From Below and Subject to the Simultaneous Action of a Magnetic Field and Rotation. II.** ***Y. Nakagawa.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 1, 1959, p. 138-145 + 2 plates.

4684* **Current Dependence of Decay of Metastable Mercury Atoms in Argon-Mercury Discharge Afterglows.** Measurements show that lifetimes of $6^3P_{2,0}$ mercury metastable states are dependent upon the amplitude of excitation pulse used to create the metastables in the absorption tube. ***Masahiro Yokoyama.*** *Science of Light*, v. 7, no. 2, Aug. 1958, p. 42-55.

4685 **Thermodynamics of One-Component Systems.** Thermodynamic principles of systems of gases and liquids; flow processes in turbines, reciprocating engines, gas compressors, and refrigerators. ***William N. Lacey and Bruce H. Sage.*** 376 pp. 1957. Academic Press, New York. (TJ265 L11t)

4686* **Toruslike Plasma Configurations Without the Total Current Through Its Cross-Section in Equilibrium With a Magnetic Field.** From the equilibrium conditions, the construction rule for a deformable (paper) model network is derived. This network is a true analogue to the totality of equilibrium surfaces of a plasma without an interior field. It is applied to a torus configuration. (*In German.*) Torusartige Plasmakonfigurationen ohne Gesamtstrom durch ihren Querschnitt im Gleichgewicht mit einem Magnetfeld. ***F. Meyer and H. U. Schmidt.*** *Zeitschrift für Naturforschung*, v. 13a, Dec. 1958, p. 1005-1015.

4687* **Plasma Polarization and Carrier-Change Effect.** The general formulation of the force on a neutral or charged particle can be simplified by making use of the separation in individual and collective components. The result justifies the polarization-approximation used here to account for the collective interaction of the system. (*In German.*) Plasmapolarisation und Trägerwechselwirkung. ***G. Ecker and K. G. Müller.*** *Zeitschrift für Physik*, v. 153, no. 3, 1958, p. 317-330.

4688* **On the Coordinate Conditions in Einstein's Theory of Gravitation.** Some relations connected with covariance of the field equations under a transformation of the variables have been derived. (*In Russian.*) O koordinatnykh usloviiakh v teorii tiagoteniia Eĭnshteĭna. ***I. G. Fikhtengol'ts.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 35, no. 6, Dec. 1958, p. 1457-1465.

4689* **Asymptotic Theory of One-Dimensional Four-Fermion Interaction.** A fermion field which interacts with itself is examined for the case when a single space and a single time coordinate are involved. (*In Russian.*) Asimptoticheskaia teoriia odnomernogo chetyrekhfermionnogo vzaimodeĭstviia. ***A. A. Ansel'm.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 35, no. 6, Dec. 1958, p. 1522-1531.

4690* **On the Limits of Applicability of the Quasiclassical Equation of State of Matter.** Quantum corrections to the equation of state obtained with the aid of the Thomas-Fermi model have been found. (*In Russian.*) O granitsakh primenimosti kvaziklassicheskogo uravneniia sostoianiia veshchestva. ***D. A. Kirzhnits.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 35, no. 6, Dec. 1958, p. 1545-1557.

PLASTICS

4691* **Polyurethane Foam.** Cast, or foamed-in-place, provides easy-to-produce structures, padding, and insulation. ***T. Patrick Dougan.*** *Aircraft and Missiles Manufacturing*, v. 2, Feb. 1959, p. 28-32.

4692* **Silicon Elastomer.** Cures at room temperature; introduced as high-temp sealant, finds encapsulating and tooling uses. ***Robert Treat, Jr.*** *Aircraft and Missiles Manufacturing*, v. 2, Feb. 1959, p. 35-37.

4693 **Structural Effects on the Polymerization of Lactams.** The polymerizability of a number of lactams to polyamides was determined. ***H. K. Hall, Jr.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6404-6409.

4694 **Polymerization of Cyclic Esters, Urethans, Ureas and Imides.** ***H. K. Hall, Jr. and A. K. Schneider.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6409-6412.

4695 Mechanism of Ethylene Polymerization With Vanadium Catalysts. ***Wayne L. Carrick.*** *American Chemical Society, Journal*, v. 80, Dec. 5, 1958, p. 6455-6456.

4696 Polymerization of Ethylene With Titanium Tetrachloride—Aluminum Triisobutyl. Linear polyethylenes in the viscosity molecular weight region 3500 to 940,000 are formed. ***Elmer J. Badin.*** *American Chemical Society, Journal*, v. 80, Dec. 20, 1958, p. 6545-6548.

4697 Polymerization of Hexene-1 With Titanium Tetrachloride—Aluminum Triisobutyl. Polyhexenes formed had low molecular weight and were low melting. ***Elmer J. Badin.*** *American Chemical Society, Journal*, v. 80, Dec. 20, 1958, p. 6549-6551.

4698 Reactions of Polymers With Reagents Carrying Two Interacting Groups. I. The Quaternization of Poly-(4-vinylpyridine) With Bromoacetic Acid. In the transition state of the quaternization reaction, the carboxylate group of the bromoacetate is at a lower electrostatic potential than the charges of the pyridinium residues. ***H. Ladenheim, E. M. Loebl, and H. Morawetz.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 20-23.

4699 The Radiation Induced *cis-trans* Isomerization of Polybutadiene. II. Kinetics of the γ-ray induced *cis-trans* isomerization of polybutadiene in benzene were studied over the temperature range 20 to 60 C, using diphenyl disulfide as a sensitizer. ***Morton A. Golub.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 54-58.

4700 Bis-(cylopentadienyl)-titanium Dichloride-Alkylaluminum Complexes as Soluble Catalysts for the Polymerization of Ethylene. ***David S. Breslow and Norman R. Newburg.*** *American Chemical Society, Journal*, v. 81, Jan. 5, 1959, p. 81-86.

4701 Preparations and Properties of Caster Oil Urethane Foams. An evaluation of the utility of castor oil and to determine the effect, on properties of the foams obtained, of varying the proportions of castor oil over the range of 50 to 80%. ***D. A. Yeadon, W. F. McSherry, and L. A. Goldblatt.*** *American Oil Chemists' Society, Journal*, v. 36, Jan. 1959, p. 16-20.

4702 Taping With Plastics. Current applications in an expanding field. *British Plastics*, v. 31, Dec. 1958, p. 498-503.

4703 Vinyl Chloride-Vinyl Acetate Copolymers. Manufacture, properties, and some aspects of the compounding and uses of copolymers having a vinyl acetate content in the range of about 3% to 20%. ***C. M. Thomas and J. R. Hinds.*** *British Plastics*, v. 31, Dec. 1958, p. 522-525.

4704 The Low Temperature Brittleness of Polymers. The Imperial Chemical Industries, Ltd. low temperature brittleness test is described with results for polythene and plasticized PVC. ***S. Turner.*** *British Plastics*, v. 31, Dec. 1958, p. 526 + 3 pages.

4705 Self Extinguishing Polyester Resins. Polyester resins are combustible, but it is possible to decrease their burning rate either by the use of additives, or by chemical modification of the resin, or both. ***B. Parkyn.*** *British Plastics*, v. 32, Jan. 1959, p. 29 + 3 pages.

4706 Accelerated Ageing of Some Thermoplastics. A survey made of the results of some investigations on the aging characteristics of toughened polystyrene, high and low density polythene, and polyvinylidene chloride. ***J. A. Laird.*** *British Plastics*, v. 32, Jan. 1959, p. 32 + 2 pages.

4707 Here's Graft Polymerization. It's on the Brink of Commercial Exploitation. Grafting refers to the operation of chemically joining two or more dissimilar polymers. Graft polymerization by radiation offers a means of chemically altering a preformed synthetic or natural polymer without changing its physical shape, and often without destroying many desirable properties. Economically feasible applications are cited. ***H. George Hammon.*** *Chemical Processing*, v. 21, Dec. 1958, p. 93-94.

4708* Modification of Structure and of Mechanical Properties of Polyethylene Induced by Atomic Radiation. Curves of ultrasonic velocity and of damping factor versus temperature (from −170 to +260 C) in polyethylene samples moderately irradiated show the existence of various transition points, due to the excitation of molecular motions of side chains, to the glass transition, the melting of crystallites, and to the rubber-like transition. The location of transition points depends upon radiation dose. (*In Italian.*) Sulle modificazioni della struttura e delle proprietá meccaniche del politene indotte dalle radiazioni atomiche. ***M. Baccaredda and E. Butta.*** *Chimica e l'Industria*, v. 40, Dec. 1958, p. 983-992.

4709* Polymerization of Olefins on Supported Catalysts. Summary of published information on the chemistry of these processes and a comparison of their salient features. ***F. X. Werber.*** *Fortschritte der Hochpolymeren-Forschung*, v. 1, no. 2, 1959, p. 180-191.

4710 Polymerization of Methyl Isopropenyl Ketone. Although the homopolymer and copolymer with styrene are both similar to poly(methyl methacrylate) in key physical properties, the latter can be injection-molded more successfully, as it is more stable thermally. ***F. Brown, F. Berardinelli, R. J. Kray, and L. J. Rosen.*** *Industrial and Engineering Chemistry*, v. 51, Jan. 1959, p. 79-82.

4711 Plastics. Important happenings in the plastics industry in 1958 are reviewed. Temporarily in oversupply in most of the best known lines of plastics, manufacturers have turned to more diversified products to expand their markets. Use of plastic materials in the building industry looks increasingly promising. ***E. L. Kropa and E. E. McSweeney.*** *Industrial and Engineering Chemistry*, v. 51, Jan. 1959, p. 36A-39A.

4712 Interpretation of Chain-Ring Equilibria in the Polymerization of Substituted ε-Caprolactam. Interpretation of the problem by changes of the thermodynamical properties caused by the existence of rotational isomers. ***Hirosuke Yumoto.*** *Journal of Chemical Physics*, v. 29, Dec. 1958, p. 1234-1239.

4713 Theory of Cold Crystallization of High Polymers. The nonequilibrium limit of random crystallization of linear high polymers is described. ***B. Wunderlich.*** *Journal of Chemical Physics*, v. 29, Dec. 1958, p. 1395-1404.

4714 Cation Exchange Resin-Catalyzed Condensation and Polymerization of Aldehydes and Cyclohexanone. Use of strongly acid cation exchange resins to catalyze the self-condensation and polymerization of aliphatic aldehydes and cyclohexanone. ***Melvin J. Astle and Murray L. Pinns.*** *Journal of Organic Chemistry*, v. 24, Jan. 1959, p. 56-60.

4715 The Effect of Molecular Weight on the Crystallinity of Polyethylene. Crystalline contents of fractions at various temperatures were calculated from the measured specific volumes. A theory was proposed to explain the dependence of crystallinity on the molecular weight of polyethylene. ***L. H. Tung and S. Buckser.*** *Journal of Physical Chemistry*, v. 62, Dec. 1958, p. 1530-1534.

4716* Cyclopolymerization. I. Polydiacrylylmethane. II. Polyacrylic Anhydride. The attempted synthesis of diacrylylmethane by the acylation of methyl vinyl ketone with ethyl acrylate produced exclusively the homopolymer of diacrylylmethane. An anionic mechanism is proposed for the cyclopolymerization of diacrylylmethane. A linear high polymer composed of repeating α-methylene glutaric anhydride units has resulted from the controlled cyclopolymerization of acrylic anhydride. ***J. F. Jones.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 7-20.

4717* Preparation and Properties of Polybenzylidene. Polybenzylidene was prepared by the decomposition of phenyldiazomethane in the presence of boron trifluoride etherate as catalyst. ***C. E. H. Bawn, A. Ledwith, and P. Matthies.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 21-26.

4718* Polymers and Copolymers of Hydronopyl Acrylate. Hydronopyl acrylate was synthesized by direct esterification of the alcohol with acrylic acid. Its homopolymer and a variety of copolymers, terpolymers, and a tetrapolymer were prepared and their properties determined. ***C. S. Marvel, Roland Schwen, R. W. Hobson, and R. J. Coleman.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 27-37.

4719* The Copolymerization Characteristics of Ethyl α-Acetoxyacrylate. ***C. C. Unruh and T. M. Laakso.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 87-94.

4720* Molecular Weight-Viscosity Relationship of Gamma-Irradiated Octadecyl Vinyl Ether and Octadecyl Methacrylate. ***Jeanne G. Fee, William S. Port, and Lee P. Witnauer.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 95-100.

4721* Dynamic Mechanical Properties of Irradiated Polyethylene. Properties of eight samples of polyethylene irradiated to various extents were determined over a temperature range from −70 to +280 C and a frequency range from 10^3 to 2×10^4 cycles/sec. ***E. Butta and A. Charlesby.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 119-128.

4722* Studies on the Low Pressure Polymerization of Ethylene Using Catalysts Containing Sodium Alkyls. ***Albert Zilkha, Nissim Calderon, and Max Frankel.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 141-152.

4723* Infrared Spectroscopy of Polyethylene Terephthalate. ***W. W. Daniels and R. E. Kitson.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 161-170.

4724* Copolymerization of Vinyl Acetate-Vinyl *n*-Butyl Ether. Data on yields and composition of copolymers of vinyl acetate and vinyl *n*-butyl ether formed at 170 C are recorded. Yield of copolymer is directly proportional to amount of vinyl acetate in the monomer mixture. ***Jerome R. Tichy.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 353-359.

4725* Initiation of Polymerization by Cyclic Peroxides. Bulk and photo initiated polymerization of styrene at 60 C were investigated in the presence of cyclic peroxides such as cyclohexanone peroxide, ascaridole, ergosterol peroxide, dimeric benzaldehyde peroxide, and cyclohexene. ***R. Baysal.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 381-388.

4726* The Initiator Efficiency of 2,2′-Azobisisobutyronitrile in the Polymerization of Styrene and Methyl Methacrylate, and Dicumyl Peroxide as a Polymerization Initiator. ***J. P. Van Hook and A. V. Tobolsky.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 429-445.

4727* Heat Aging Characteristics of Bis-Phenol-Epoxy Resins. Aging characteristics of a particular bis-phenol-epoxy resin at different hardener concentrations were investigated by measuring torsion oscillation and shrinkage. (*In German.*) Über das thermische Alterungsverhalten von Bisphenol-Epoxydharz-Systemen. ***P. Nowak and E. Steinbacher.*** *Kunststoffe*, v. 48, Dec. 1958, p. 558-563.

4728 Laminated Plastics, Including High-Pressure and Low-Pressure Types and Reinforced Plastics. Chemistry and properties of resins, base materials and reinforcements, manufacturing processes, grades and characteristics of high-pressure laminates, machining of laminated plastics and molded parts, heat-resistant and other special laminates, and applications and end products. ***D. J. Duffin.*** 254 pp. 1958. Reinhold Publishing Corporation, New York. (TP986.A2 D87L)

4729* Injection Moulding and Machining of Nylon. Indicates the experience which has been gained in the injection molding and machining of nylon. *Machinery Lloyd (Overseas Ed.)*, v. 30, no. 26, Dec. 20, 1958, p. 79-83.

4730* Some Conversions of Crosslinked Polymethacrylic Acid. The conversion of crosslinked polymethacrylic acid into polymethacrylic acid chloride and polymethacrylic acid amide was investigated. The Hofmann reaction was performed on crosslinked polymethacrylic acid amide and the degradation products were analyzed. (*In German.*) Über einige Umsetzungen an vernetzter Polymethacrylsäure. ***Georg Manecke and Ruth Heller.*** *Makromolekulare Chemie*, v. 28, no. 3, Dec. 1958, p. 185-196.

4731* Stereospecific Polymerization and Isotactic Polymers of Vinyl Aromatic Monomers. ***Giulio Natta, Ferdinando Danusso, and Dario Sianesi.*** *Makromolekulare Chemie*, v. 28, no. 3, Dec. 1958, p. 253-261.

4732 The Year 1958 in Review. Further advances in the technology and application of polyformaldehyde, polycarbonates, chlorinated polyethers, polyethylene oxide, linear polyethylene, and polypropylene are presented in this review. *Modern Plastics*, v. 36, no. 5, Jan. 1959, p. 135 + 8 pages.

4733* Effects of High Energy Radiation on Polymers. II. End-Linking and Gel Fraction. III. Viscosity. ***Osamu Saito.*** *Physical Society of Japan, Journal*, v. 13, Dec. 1958, p. 1451-1476.

4734* How to Machine Glass Base Laminated Plastics. Sawing, shearing and slitting, punching, drilling, tapping threading, and machining. ***E. C. Graesser.*** *Plastics Industry*, v. 17, Jan. 1959, p. 34-35.

4735* Carbopol—Goodrich's Versatile New Polymer. Volume production of Carbopol, a fluffy white powder that "improves the performance qualities of hundreds of existing products ranging from toothpaste to asphalt", has been announced. *Plastics Industry*, v. 17, Jan. 1959, p. 36-37.

4736* Application of Nuclear Energy to the Polymer Field. Reviews mechanics of radiation and their application in polymerization reactions for resins. ***Daniel Greenberg.*** *Plastics Technology*, v. 5, Jan. 1959, p. 29-32.

4737* Development of Steam-Resistant Fiberglass-Reinforced Plastics. Report on a test program emphasizing the need for hydrolysis-resistant polyesters, exclusion of water from materials, synthetic fiber overlays, cure operations, and the quality of premix compound products. ***E. G. Bobalek, W. M. Ellslager, and Thomas Harris.*** *Plastics Technology*, v. 5, Jan. 1959, p. 33 + 6 pages.

4738* Extrusion Theory. II. Understanding of the theoretical aspects of the extrusion operation is necessary to obtain optimum results in machine performance. ***H. M. Hulburt, Stanley Katz, and L. F. Street.*** *Plastics Technology*, v. 5, Jan. 1959, p. 39 + 6 pages.

4739* Controlled-Pressure (Valve) Extrusion. Sheet extrusion of polyethylene, impact polystyrene, and vinyl dry blends are discussed. ***B. H. Maddock, H. J. Nalepa, and B. Zurkoff.*** *Rubber and Plastics Age*, v. 39, Dec. 1958, p. 1073 + 5 pages.

4740* Sheet Extrusion and Vacuum Thermo Forming of Higher Density Polyethylenes. ***J. G. Farrow.*** *Rubber and Plastics Age*, v. 39, Dec. 1958, p. 1098-1100.

4741* Get Better Parts With Proper Mold-Filling Rates. An indication of how the fill pattern of a mold is affected by injection pressure, cylinder temperature, ram speed, and mold temperature uniformity will give clues for achieving better dimensional tolerances, controlling surface finish, and reducing some types of molding defects. ***Gordon B. Lankton.*** *SPE Journal*, v. 15, Jan. 1959, p. 31 + 4 pages.

4742* Flammability Evaluations in Safety Codes. How flammable can plastics be? Without adequate testing and publication of the facts, plastics products may be the cause of a disastrous fire. ***Mathew M. Braidech.*** *SPE Journal*, v. 15, Jan. 1959, p. 35-37.

4743* Epoxy Novolacs. New range of applications for epoxy resins is opened up with these highly functional polymers which provide the thermal stability of novolacs and the fabricating ease of epoxies. ***D. D. Applegath, R. F. Helmreich, and G. A. Sweeney.*** *SPE Journal*, v. 15, Jan. 1959, p. 38-42.

4744* Properties of Foams and Laminates Under Shock Loading. Srength of materials varies significantly under high rates of loading, and should therefore be considered in selecting resins for applications which may be subjected to shock. Comparative data are presented on polyurethane foam and several structural laminates. ***Ross H. Supnik and Melvin Silberberg.*** *SPE Journal*, v. 15, Jan. 1959, p. 43-47.

4745* Plastics for Communications Cables and Lines. Specifications of polystyrene styroflex, polyethylene, PVC, polyisobutylene, and synthetic rubber used for communication cables. ***Hans Haselhorst.*** *Siemens Review*, v. 25, no. 7, 1958, p. 250-255.

4746* The Copolymerization of Vinyl Chloride and Methacrylic Acid Esters. Copolymerization of vinyl chloride and methyl-, n-butyl-, n-octyl acrylate and vinyl benzoate was studied. It was found that methacrylate copolymers are less homogeneous than the acrylates. (*In Russian.*) Sovmestnaia polimerizatsiia khloristogo vinila s efirami metakrilovoĭ kisloty. ***G. V. Tkachenko, L. V. Stupen', L. P. Kofman, and L. A. Karacheva.*** *Zhurnal Fizicheskoi Khimii*, v. 32, no. 11, Nov. 1958, p. 2492-2499.

See also: **3850** (markets for plastics—1958); **4009** (gases in polymers); **4062** (vinyl ether copolymers); **4486** (epoxide forging tools); **4488** (epoxide tooling).

POLLUTION AND WASTES

4747* Laboratory Culture of Taste- and Odor-Producing Aquatic Actinomycetes. Description of a few techniques and equipment designed for rearing the aquatic actinomycetes and the methods for the concentration and study of the taste and odor compounds. ***J. K. G. Silvey and A. W. Roach.*** *American Water Works Association, Journal*, v. 51, Jan. 1959, p. 20-32.

4748* Topographic and Meteorological Factors Influencing Air Pollution in Cincinnati. Hourly records of suspended particulate matter have been obtained for periods of four to eight months from some 60 homes in the city of Cincinnati. ***Roy J. Shephard.*** *Archives of Industrial Health*, v. 19, no. 1, Jan. 1959, p. 44-54.

4749 What Is Safe Waste Disposal? Discusses quantities of radioactive waste to be expected in the future, hazardous environmental levels, and some potential means for disposition of wastes. ***Wallace De Laguna.*** *Bulletin of the Atomic Scientists*, v. 15, no. 1, Jan. 1959, p. 35-43.

4750* A Fundamental Study on the Infiltration Characteristics of Radioactive Liquid Wastes. Discusses the adsorption phenomena of radioactive liquid percolating into soil, on the basis of an ideal case in which the liquid, having only one kind of nuclide, is flowing downwards through homogeneous porous media of soil, one-dimensionally. Combining Horton's Infiltration Law and Langmuir's Adsorption Theory, a new theory is proposed to estimate the variation of the ionic concentration in the liquid infiltrating through the medium layer. ***Shigehisa Iwai, Takeshi Gōda, and Yoriteru Inoue.*** *Kyoto University, Memoirs of the Faculty of Engineering*, v. 20, pt. 4, Oct. 1958, p. 350-361.

4751 Modern Methods of Mechanical Pulp Manufacture. A description of the modern methods of groundwood production based on an extended study of the industrial practices of wood grinding in progressive groundwood mills of both Germany and Canada, and an extensive review of American and western European literature. ***K. H. Klemm.*** 241 pp. 1958. Lockwood Trade Journal Co., New York. (TS1175 K67ntr)

4752 Zinc-65 in Foods and People. Disposal of trace amounts of Zn^{65} is made in the Columbia River via Hanford reactor effluent water. The subsequent utilization of river water for irrigation permits the concentration of this radioisotope in farm produce and its eventual deposition in man. The Zn^{65} in irrigation water, in farm produce, and in individuals utilizing these materials has been measured. ***R. W. Perkins and J. M. Nielsen.*** *Science*, v. 129, Jan. 9, 1959, p. 94-95.

4753* Sewage Treatment Needs of the United States. Describes municipal sewage treatment needs and number of systems or plants and the estimated population connected with each category of needs. Almost 4,000 new plants are needed to serve 22.2 million persons. ***Gordon E. McCallum and John R. Thoman.*** *Sewage and Industrial Wastes*, v. 31, Jan. 1959, p. 1-7.

4754* Biochemistry of Sewage Treatment. A survey is given of known and presumed biochemical processes occurring in biological treatment of sewage. (*In Swedish.*) Avoppsvaltenbehandlingens biokemi. ***Lennart Enebo.*** *Svensk Kemisk Tidskrift*, v. 70, no. 11, 1958, p. 465-484.

4755* Future Developments in Water and Sewage. Five practices to increase the water supply needed for municipal and industrial uses. Water tailoring. New trends in coagulation, sedimentation, filtration. Sewage disposal, the use of syndets. Sludge disposal. ***George E. Symons.*** *Water & Sewage Works*, v. 106, Jan. 1959, p. 38-43.

RUBBER AND ELASTOMERS

4756 Bulk Polymerization in Natural Rubber Swollen by Methyl Methacrylate. Preparation of polymer-modified rubbers. The course of the reaction, using different catalyst systems, is followed by recording the temperature rise under conditions of low heat loss, and some suggestions are made as to the molecular weight of polymer formed at different stages of the reaction. The polymer-modified rubbers are characterized by separation into their 'free' and 'graft' components, and their physical propetries are described. A large-scale preparation is described where initiation of polymerization is sustained under conditions of low heat loss by the use of a mixed catalyst system. ***P. McL. Swift.*** *Journal of Applied Chemistry*, v. 8, Dec. 1958, p. 803-810.

4757* The Rupture Process in Carbon-Loaded Rubbers: An Electron-Microscopic Investigation. A study was made of the disposition of carbon-black particles in the tear and fracture surfaces of various filled rubbers by replica electron microscopy. ***E. H. Andrews and A. Walsh.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 39-52.

4758* Tensile Strength of Filled GR-S Vulcanizates. The fillers used were HAF black, $CaCO_3$, and a high styrene-butadiene copolymer (Pliolite S-6). Measurements were made as a function or filler concentration, temperature, and degree of crosslinking. ***F. Bueche.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 259-271.

4759* α,β-Unsaturated Ketones. III. Copolymers of Perfluoroalkyl Propenyl Ketones With Dienes. The preparation and properties of copolymers of three perfluoroalkyl propenyl ketones with different 1,3-dienes are described. Emulsion copolymerization at 50 C and at 5 C of perfluoromethyl, perfluoropropyl, and perfluoroheptyl propenyl ketones with 1,3-dienes, such as butadiene, 1,1,2-trifluoro-3-chlorobutadiene, 1,1,2-trifluorobutadiene, and isoprene, was accomplished and many of the products exhibited elastomeric properties. Qualitative determinations of thermal stability and solvent resistance were made. ***F. B. Jones, L. E. Coleman, Jr., and P. B. Stickney.*** *Journal of Polymer Science*, v. 33, Dec. 1958, p. 405-416.

4760 Synthetic Rubbers in the Post-War World. Starting with a description of the six types of synthetic rubber available at the end of the second World War, the author traces the developments which have since occurred, and concludes with details of some new types which have made their appearance in the intervening years. ***S. H. Morrell.*** *Research*, v. 12, Jan. 1959, p. 7-14.

4761* Rubber Adhesion to Metals. Various processes currently used for rubber bonding are examined. As the range of possible products is very wide, the actual choice will depend largely upon the nature and size of fabrications. (*In French.*) L'adhérence du caoutchouc aux métaux. ***M. A. Julien.*** *Revue générale du Caoutchouc*, v. 35, Nov. 1958, p. 1359-1362.

4762* Gasolines vs. Elastomers. This study was made to observe the suitability of the more commonly used oil-resistant elastomers for applications involving fuel contact. ***John J. Prendergast.*** *Rubber Age*, v. 84, no. 4, Jan. 1959, p. 619-626.

4763* Natural Rubber Compounds for High Temperature Service. Compounding of natural rubber to give improved heat resistance. ***W. P. Fletcher and S. G. Fogg.*** *Rubber Age*, v. 84, no. 4, Jan. 1959, p. 632-638.

4764* Changes in Polysulfide Chain Length in Sulfur Structures of Vulcanizates by Light. ***A. F. Postovskaya, M. A. Salimov, and A. S. Kuzminskiĭ.*** *Rubber Chemistry and Technology*, v. 31, no. 4, Oct-Nov. 1958, p. 747-750. (Trans-

lated from *Doklady Akademii Nauk*, SSSR, v. 114, no. 3, 1957, p. 586-589.)

4765* **The Mechanism of Vulcanization in the Presence of 2-Mercaptobenzothiazole.** ***B. A. Dogadkin, I. A. Tutorskiĭ, and D. M. Pevzner.*** *Rubber Chemistry and Technology*, v. 31, no. 4, Oct.-Nov. 1958, p. 751-755. (Translated from *Doklady Akademii Nauk, SSSR*, v. 112, no. 3, 1957, p. 449-452.)

4766* **The Chemistry of Vulcanization. I. Diphenylmethane as a Model of Rubber Hydrocarbon for Its Reaction With Sulfur. II. Kinetics of Hydrogen Sulfide Evolution During the Reaction of Diphenylmethane and Sulfur. III. The Action of Amines on the Reaction of Diphenylmethane With Sulfur. IV. Action of 2-Mercaptobenzothiazole on the Reaction of Diphenylmethane and Sulfur. V. Action of 2,2'-Benzothiazolyl Disulfide on the Reaction of Diphenylmethane and Sulfur.** I, II, III. ***Jitsuo Tsurugi.*** IV. ***Jitsuo Tsurugi and Takesige Nakabayashi.*** V. ***Jitsuo Tsurugi and Haruko Fukuda.*** *Rubber Chemistry and Technology*, v. 31, no. 4, Oct.-Nov. 1958, p. 762-799. (Reprinted from the *Bulletin of the University of Osaka Prefecture*, v. 5, ser. A, 1958, p. 135 + 21 pages, v. 6, ser. A, 1958, p. 145-154.

4767* **Speed of Mixing Rubber as a Factor in Processing.** Methods being put into practice for speeding up this process are use of mechanical weighing and loading of the materials used in the mixing process, increasing the speed of rotation of the mixing rotors, and applying higher pressures to the mixing chamber. ***N. V. Priklonskaya.*** *Rubber Chemistry and Technology*, v. 31, no. 4, Oct.-Nov. 1958, p. 907-924. (Translated from *Kauchuk i Rezina*, 1957, no. 4, p. 9-19.)

4768* **Surface Heating by Friction and Abrasion by Thermal Decomposition.** A mathematical appraisal of frictional temperatures which may occur in tires under various driving conditions. ***W. Viehmann.*** *Rubber Chemistry and Technology*, v. 31, no. 4, Oct.-Nov. 1958, p. 925-940.

4769* **Properties of Elastomers up to 550° F. I.** Heat resistance of compounds of currently available elastomers at temperatures up to 550 F. Elastomers tested were Hevea, SBR, butyl rubber, Hypalon, neoprene, NBR, acrylate rubbers, Fluoro-Rubber 1F4, Thiokol, polysulfide rubber, polyurethanes, silicone rubber, Kel-F Elastomer, and Viton A. ***F. M. Smith.*** *Rubber World*, v. 139, no. 4, Jan. 1959, p. 533-541.

4770* **Vinyl Foam.** A review of compounding, processing, properties, and manufacture of vinyl foam. Includes data on effect of plasticizer concentration on load deflection properties. ***Calvin S. Yoran and Robert J. Stockman.*** *Rubber World*, v. 139, no. 4, Jan. 1959, p. 542-546.

4771* **On the Abrasion of Vulcanized Rubber Against Wire Gauze.** Tests were made on rubbers of similar composition; their properties were changed over a wide range either through changing the nitrile content in butadiene-nitrile rubber or by means of swelling of the rubber in dibutylphthalate or by varying the loading of the rubber. ***S. B. Ratner, V. E. Gool, and G. S. Klitenick.*** *Wear*, v. 2, no. 2, Nov. 1958, p. 127-132.

See also: **3901** (carbon black); **4841** (rubber-base adhesives).

SPACE HEATING AND CONDITIONING

4772* **Economical Solar Heating Nears.** Describes a 1,440-square-foot, one-story, ranch-type structure at Tucson, Arizona, which has been designed to provide a comprehensive facility for technical study of applied solar energy. *Air Conditioning, Heating, and Ventilating*, v. 56, Jan. 1959, p. 71-72.

4773* **Gas Powered Air Conditioning.** Refrigeration and dehumidification cycles are described with data on characteristics, application, and economic considerations. ***Paul E. Chamberlin, et al.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Jan. 1959, p. 75-87.

4774* **Air Conditioning Thor.** Reliability of ground-support equipment is enhanced by built-in test devices which allow monitoring of components not in continuous operation. ***J. Philip Geddes.*** *Aircraft and Missiles Manufacturing*, v. 2, Feb. 1959, p. 7-9.

4775* **Ventilation of Mine Sections by Applying Auxiliary Aeration.** (*In Hungarian.*) Bányarészek szellőztetése segédszellőztető alkalmazásával. ***Iván Tarján and Zoltán Sasváry.*** *Bányászati Lapok*, v. 91, nos. 10-11, Nov. 1958, p. 703-705.

4776* **The Use of Integrating Instruments for Acceptance Tests in Industrial Heating and Refrigerating Insulation Practice.** An integrating instrument suitable for both domestic and industrial use. (*In German.*) Die Verwendung von Zählgeräten für Abnahmeversuche im industriellen Wärme- und Kälteschutz. ***W. F. Cammerer and C. Cammerer.*** *Brennstoff-Wärme- Kraft*, v. 11, no. 1, Jan. 1959, p. 17-20.

4777 Dust Precipitation by Sonic and Ultrasonic Vibrations. Covers theory of agglomeration, ultrasonic generation equipment, processes and properties, and technical installations. ***A. Willner.*** *Henry Brutcher Translation No.* 4404, 21 pp. (Slightly abridged translation from *Bergbau-Technik*, v. 5, no. 4, 1955, p. 201-209.) Henry Brutcher, Altadena, Calif.

4778 Methods of Noise Control. Consist of source elimination, by modification, enclosure, noise absorption, or providing soundproof booth or ear defenders. ***T. F. W. Embleton.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 1, Feb. 1959, p. 37-43.

4779* **Solar Research for Fuel-Less Heating.** Describes the facility at the Institute of Atmospheric Physics, University of Arizona, Tucson. *Electric Heat and Airconditioning*, v. 5, no. 1, Jan.-Feb. 1959, p. 34-35.

4780* **Electric vs. Gas Service—What's Best for Military Housing?** Economic analysis for making a choice between all-electric and combination gas-electric service for a military multiple housing project. *Electrical World*, v. 151, Jan. 19, 1959, p. 63-66.

4781* **German Experiences With Electric Storage Space Heating.** Factors influencing the power consumption, such as the size of the room, wind, heat transmission, thermal insulation, degree days, mode of operation, and losses by openings are discussed and theoretically analyzed. (*In German.*) Deutsche Erfahrungen mit elektrischer Speicher-Raumheizung. ***H. Masukowitz and W. Samwer.*** *Elektrowärme*, v. 16, Nov. 1958, p. 380-400.

4782* **Gas Dehumidifies Army Storage Cave.** In a 60-acre limestone cave at Atchison, Kan., natural gas is helping to maintain low humidity and to preserve tools in storage by removing 7000 gal. of water daily. ***Ralph Smith.*** *Gas*, v. 35, Feb. 1959, p. 71-74.

4783* **New Baseboard System Couples Electric Heat With Warm Air.** The comfort of warm air and the elegance of electric heating are combined in newly designed air-type heating system. ***A. L. Yeager.*** *Heating & Air Conditioning Contractor*, v. 50, no. 4, Jan. 1959, p. 67-72.

4784 Outline Specs for Test Chambers. Chambers simulate space travel for rockets and missiles—taking them through their paces of extreme heat and cold. ***B. F. Rose, Jr.*** *Heating, Piping & Air Conditioning*, v. 31, Jan. 1959, p. 121-125.

4785 Unique Control System Regulates Air Conditioning, Heating. Scheme benefits from low installation cost, minimum maintenance, high reliability. ***John F. Pink.*** *Heating, Piping & Air Conditioning*, v. 31, Jan. 1959, p. 130-133.

4786 Winning the Air Conditioning Odor Fight. I. Know Your Nose—Your Nose Knows. Explains the common concept or odors, how they can be detected, and their relationship to psychology. ***Albert B. Hubbard.*** *Heating, Piping & Air Conditioning*, v. 31, Jan. 1959, p. 138-139.

4787 Nuclear or Solar Energy: Which Is More Practical for Space Heating? ***George W. Rusler.*** *Heating, Piping & Air Conditioning*, v. 31, Feb. 1959, p. 106-112.

4788 The Photolysis of Nitrosyl Chloride and the Storage of Solar Energy. The nitric oxide formed is insoluble and can be stored and later recombined with chlorine in carbon tetrachloride to give the original nitrosyl chloride and release some of the solar energy consumed in the photolysis. ***Otto S. Neuwirth.*** *Journal of Physical Chemistry*, v. 63, Jan. 1959, p. 17-19.

4789 A Thermocouple Method for Measuring Relative Humidity in the Range 95-100%. At high relative humidities a current of 30mA through a 38 s.w.g. chromel-*p*/constantan thermocouple produces sufficient Peltier cooling to form a film of water on the junction which may then be used as the wet-bulb of a psychrometer. The wet-bulb depression can be read to 0.001 C and in the range 97-100% changes of 0.01% relative humidity can be detected. ***J. L. Monteith and P. C. Owen.*** *Journal of Scientific Instruments*, v. 35, Dec. 1958, p. 443-446.

4790* The Use of Freon-30 as a Cooling Agent. Shows that the use of freon-30 leads to marked decrease in the heat transmitting surface and it may be recommended as a cooling agent for moderately low and for low temperatures. (*In Russian.*) Primenenie freona-30 v kachestve teplonositelia. ***K. Kan.*** *Kholodil'naia Tekhnika*, v. 35, no. 6, Nov.-Dec. 1958, p. 22-26.

4791* Liquid Metals for Heating and Cooling. V. *Frank H. Slade.* *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 1, Jan. 3, 1959, p. 70-75.

4792* Case Study in Reducing Machine Noise. Techniques that can minimize machine noise across the audible range. ***Donald B. Smith.*** *Metalworking Production*, v. 102, no. 51, Dec. 19, 1958, p. 2222-2223.

4793* Predicting Leaving Dry Bulb Temperatures for Air Conditioning Coils. Concludes that the geometry of a coil has an almost negligible effect on this relationship so there is an excellent chance of correlating existing and new test data to obtain an accurate method. ***Alan S. Decker and Sebastian Gianni.*** *Refrigerating Engineering*, v. 67, Jan. 1959, p. 33-36.

4794* Sound Attenuation in Straight Ventilation Ducting. Attenuation studied over the range of 20 to 10,000 cps. Results are unaffected by air velocity or by size when near 12 x 12 inches. ***J. B. Chaddock, J. K. Nunnely, T. L. Moore, and H. H. Bell.*** *Refrigerating Engineering*, v. 67, Jan. 1959, p. 37-42.

4795* Design Search for the Foolproof Air Conditioner. Continued improvements will be seen in all phases of air conditioning design. ***P. W. Wyckoff.*** *Refrigerating Engineering*, v. 67, Jan. 1959, p. 43-47.

4796* Temperature-Controlled Chamber Using Thermoelectric Cooling. Thermoelectric cooling, using the Peltier principle, has many potential uses in the refrigeration field. However, great improvements will have to be made in the materials before it can replace conventional refrigeration in most present day applications. ***W. R. Danielson.*** *Refrigerating Engineering*, v. 67, Feb. 1959, p. 30-33.

4797* Design and Performance of a Thermoelectric Refrigerator. Comparisons are made between thermoelectric and regular production type refrigerators. Special applications now exist where the thermoelectrics can be used and further improvements in basic properties of semiconductors materials could move thermoelectric cooling well into competitive phases. ***J. B. Heinicke.*** *Refrigerating Engineering*, v. 67, Feb. 1959, p. 34-36.

4798* How Hot Is a House? Interim report on temperatures attained in structural members of a wood frame residence. *Southern Lumberman*, v. 198, Jan. 1, 1959, p. 28-29.

4799* The Effect of Contact Thermal Resistances of a Pellet Insulation. Data on the properties of a pellet insulation and results of tests of the deformed pellets. (*In Russian.*) Vliianie kontaktnykh teplovykh soprotivleniĭ dlia sharikovoĭ izoliatsii. ***A. F. Begunkova.*** *Teploenergetika*, v. 5, no. 12, Dec. 1958, p. 85-86.

4800* Brighter Workshops for Health and Safety. Expounds the value of high-level light conditioning. ***H. C. Weston.*** *Times Review of Industry*, v. 13, Jan. 1959, p. 50 + 1 page.

4801 Potential Applications of Nuclear Energy for Process and Space Heat in the United States. Studies the potential opportunity for the use of nuclear reactors to satisfy process and space heat requirements in the continental United States and Alaska. Emphasis is on manufacturing industries that utilize large quantities of process heat and therefore may be considered possible future users of heat-generating reactors. ***Paul L. Geiringer and Morton J. Goodfriend.*** *U. S. Atomic Energy Commission*, NYO-2332, Oct. 1958, 264 pp. (UF767 U3ny Contin.)

See also: **3874** (specific heat of Freon-142).

TEXTILES, FIBERS, LEATHER, AND PAPER

4802* Growth and Organized Development of Cultured Cells. II. Organization in Cultures Grown From Freely Suspended Cells. Normal roots may arise in the liquid medium and, once these have originated, the cultures will develop shoots when they are placed on a semisolid agar medium and are enabled to grow in a polarized way in stationary cultures exposed to air. ***F. C. Steward, Marion O. Mapes, and Kathryn Mears.*** *American Journal of Botany*, v. 45, no. 10, Dec. 1958, p. 705-708.

4803 Antibacterial Activity of the Heartwood of *Haematoxylon braziletto.* Describes a water-soluble compound which can be bactericidal for *Salmonella typhosa* and *Micrococcus pyogenes* var. *aureus* and can temporarily inhibit the growth of *Escherichia coli*. ***Robertson Pratt and Yoko Yuzuriha.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, Jan. 1959, p. 69-72.

4804* The Chemistry of Western Australian Plants. X. The "Primary" Tars From Jarrah and Karri Sawdusts. ***D. K. Dougall and D. E. White.*** *Australian Journal of Applied Science*, v. 9, no. 4, Dec. 1958, p. 404-409.

4805* The Organization of the Primary Wall in Differentiating Conifer Tracheids. In cells with localized apical growth, surface enlargement takes place by the multi-net mechanism of wall growth. Differences in microfibril orientation on the inner and outer surfaces of the cell wall and the existence of well-developed corner thickenings, closely resemble similar features in elongating coleoptile parenchyma. ***A. B. Wardrop.*** *Australian Journal of Botany*, v. 6, no. 4, Nov. 1958, p. 299-305 + 3 plates.

4806* Surface Texture of Wood as Related to Glue-Joint Strength. Surface roughness has little effect on joint strength. Adhesive joint properties are more important. The real problem, however, is strength reduction caused by contact of springwood with summerwood. ***J. E. Marian, D. A. Stumbo, and C. W. Maxey.*** *Forest Products Journal*, v. 8, Dec. 1958, p. 345-351.

4807* Forestry Education and Research in Russia. Evaluation of the forest land wealth and organization in Russia today, educational pattern in general, forest technological institutes, forest management curriculum, student prerequisites, foresty research. A comparison with American standards is attempted. ***Hardy L. Shirley.*** *Journal of Forestry*, v. 56, Dec. 1958, p. 892-899.

4808* The Ampliscope—an Instrument for Wood-Fiber Measurements. Construction details, fundamental and accessory uses based on a standard reflecting principle and relatively inexpensive components. ***R. M. Echols.*** *Journal of Forestry*, v. 57, Jan. 1959, p. 43-44.

4809 Black Wattle Catechin. Presents the first recorded isolation of a catechin (flavan-3-ol) of the resorcinol series from natural sources. ***D. G. Roux and A. E. Maihs.*** *Nature*, v. 182, Dec. 27, 1958, p. 1798.

4810* The Beech Utilization Conference. Summarizes and up-dates the contents of the papers which have been published over the last seven years. Papers cover physical and mechanical properties, storage, steam bending, chemical utilization, gluing

techniques, and many applications of American beech. Discusses future research needs. ***Fred C. Simmons.*** *Northeastern Logger*, v. 7, no. 8, Feb. 1959, p. 10 + 2 pages.

4811* Papyrus as a Raw Material for the Production of Insulation and Hardboard. Cooking variables, the degree of refining of the pulp and the pressure employed in forming the boards were investigated with respect to their influence on the properties of the insulation boards obtained. Conditions were found in which insulating boards with properties conforming to British Standard specifications could be produced with a yield of about 80%. The relatively high flexibility of the papyrus boards compared with boards from eucalyptus was found to be related to differences in the fibre-length distribution of the respective raw materials and to the screen analysis of the boards. ***Menachem Lewin and Avraham Lengyel.*** *Research Council of Israel, Bulletin*, v. 6C, no. 3, Aug. 1958, p. 181-196.

4812* Laboratory and Semi-Pilot-Plant Scale Extraction of Tannin From the Bark of *Eucalyptus rostrata*. Best results were obtained with a solution of 0.03N Na_2SO_3 at 80-82 C. Under these conditions a solution of 7.2% tannin was obtained. ***O. Elsner, E. Krakauer, J. Feist and M. Lewin.*** *Research Council of Israel, Bulletin*, v. 7A, no. 4, Sept. 1958, p. 210-212.

4813* Some Aspects of Papermaking Properties of Wood Pulps. ***George A. Richter.*** *Tappi*, v. 41, Dec. 1958, p. 776-795.

4814 The Technology of Cordage Fibres and Rope. A modern and technological presentation of ropemaking: materials, methods, and applications. ***David Himmelfarb.*** 370 pp. 1957. Interscience Publishers, New York. (TS1785 H57t)

See also: **4074** (use of silicones on textiles).

WELDING AND JOINING

4815* Brazing Aluminum to Stainless. Process is useful for composite structures in fabricating heat exchanger parts. ***Amiel Gelb.*** *Aircraft and Missiles Manufacturing*, v. 2, Jan. 1959, p. 48-49.

4816* Development of Standardizable Test Methods for Metal Bonds. Procedures for strength determinations are described, as bases for a unification of methods of testing metal-to-metal bonds. States that the most important properties of a metal-to-metal bonded joint can be determined by appropriate static and fatigue tests. (*In German.*) Beitrag zur Ausarbeitung normungsfähiger Prüfverfahren für Metallklebeverbindungen. ***H. Winter and H. Meckelburg.*** *Aluminium (Düsseldorf)*, v. 35, Jan. 1959, p. 21-28.

4817 Ultrasonic Welding for Automotive Uses. New, more versatile, more powerful equipment is shown. *Automotive Industries*, v. 120, no. 2, Jan. 15, 1959, p. 60-61.

4818 Industrial Practice in Cold Pressure Welding. The principles of cold welding, preparation of metal surfaces for welding, and the influence of die design on weld strength are described. Applications of the process to the welding of aluminum and copper foil, sheet, wire, rod, and tubes for the electrical, electronic, and other industries are reviewed. ***J. A. Donelan.*** *British Welding Journal*, v. 6, Jan. 1959, p. 5-12.

4819 Pressure Welding by Rolling. For room temperature welding, a deformation of 60-70% is required with aluminum, copper, lead, tin, and zinc to obtain weld strengths equivalent to those of solid metal. With the harder metals investigated (aluminum and copper), the bond strength is low for a region of about 1 in. from the edge of the composite. The maximum bond strength that can be achieved at room temperature can be calculated on the assumption that there are present, on the surface of the composite brittle oxide, films which come together at an early stage of their progress through the roll gap and thereafter behave as one. ***L. R. Vaidyanath, M. G. Nicholas, and D. R. Milner.*** *British Welding Journal*, v. 6, Jan. 1959, p. 13-28.

4820 Influence of Relative Interfacial Movement and Frictional Restraint in Cold Pressure Welding. The importance of results on the development of pressure welding theory is to emphasize that the two main requirements, (a) oxide fracture and its subsequent dispersal, and (b) modification of surface roughness, are independently operative, and that their relative significance is determined both by the metals to be joined and by the design of deforming tool. ***E. Holmes.*** *British Welding Journal*, v. 6, Jan. 1959, p. 29-37.

4821 Tests on Welded Connections Between I-Section Beams and Stanchions. Describes 15 tests carried out on various types of joints, and their behavior. Conclusions are drawn from these tests and recommendations are made. ***L. G. Johnson.*** *British Welding Journal*, v. 6, Jan. 1959, p. 38-46.

4822 Reactions of Silicon and Manganese in Submerged Arc Welding of Low-Carbon Steel. Effect of composition of flux, of parent and electrode metal on silicon and manganese reactions. Welding of low-carbon rimmed O. H. steel under passive and under active fluxes. Conditions under which a sound (dense) weld metal is obtained when using low-carbon rimmed steel electrodes. Silicate inclusions in weld metal and control of their amount by changing the viscosity of the flux. ***K. V. Lyubavskii.*** *Henry Brutcher Translation No.* 4331, 24 pp. (From *Avtogennoe Delo*, v. 18, no. 7, 1947, p. 1-10.) Henry Brutcher, Altadena, Calif.

4823 Joining of Metals in Solid State by Ultrasonic Vibrations. Quality of spot and continuous joints from the use of ultrasonic waves as function of physical properties, surface condition and thickness of metals joined, in copper, aluminum, duralumin, and stainless steel sheets. ***Yu. I. Kitaigorodskii, M. G. Kogan, V. A. Kuznetsova, N. N. Rykalin, and L. L. Silin.*** *Henry Brutcher Translation No.* 4401, 5 pp. (From *Izvestiya Akad. Nauk SSSR. Otd. Tekh. Nauk*, no. 8, Aug. 1958, p. 88-90.) Henry Brutcher, Altadena, Calif.

4824 Welding and Metallurgical Research. Recent investigations show that indiscriminate preheating may result in poor temper and quality of weldment. ***Robert F. Scott.*** *Canadian Metalworking*, v. 22, Jan. 1959, p. 34.

4825 Corrosion of Steel Weldments. Forty-six different steel weldments were subjected to 12 months' alternate immersion in 3% NaCl solution. Weight loss was more dependent on the type of steel than the nature of the weld, but severity of corrosion in the weld region was affected by both factors. ***J. U. MacEwan and H. H. Yates.*** *Corrosion*, v. 15, Jan. 1959, p. 18-22.

4826 How to Do a Better Welding Job. Considers the base metal, geometry of the weld, welding process, and size and type of electrode or filler metal to use. ***Ray Kolb.*** *Engineering and Mining Journal*, v. 160, Jan. 1959, p. 71-78.

4827 Investigation Into Slag Welding With Plate Electrodes. Cites problems and gives practical recommendations for welding settings. ***B. A. Koch.*** *Engineer's Digest*, v. 19, Dec. 1958, p. 513-515. (Translated from *Svarochnoye Proizvodstvo*, no. 11, Nov. 1958, p. 3-7.)

4828 Revise ASA Butt Welding Standards to Simplify Layout, Fabrication of Piping Systems. The Standards are sponsored jointly by the Mechanical (Heating, Piping, and Air Conditioning) Contractors Association of America, the Manufacturers Standardization Society of the Valve and Fittings Industry, and the ASME. This article discusses their highlights. ***H. H. George.*** *Heating, Piping & Air Conditioning*, v. 31, Feb. 1959, p. 123-127.

4829* Automatic Equipment Brazes and Tests 7 Joints in 4 Minutes. Seven joints in an automatic transmission cover are assembled, brazed and tested by a single operator in less than four minutes. Reject rate is less than 1%. *Industry & Welding*, v. 32, Feb. 1959, p. 28-29.

4830* Arc Welding 27 Types of Stainless Steel With 18 Different Coated Electrodes. Includes an electrode selection chart. ***W. E. McFee.*** *Industry & Welding*, v. 32, Feb. 1959, p. 30 + 2 pages.

4831* High-Strength Welded Fabrications Replace Aircraft Forgings. Rohr Aircraft Co. uses low-alloy high strength weldments because they usually cost and weigh less than ma-

chined forgings; design changes and production scheduling are easier, too. *Industry & Welding*, v. 32, Feb. 1959, p. 38 + 2 pages.

4832* Welding Hastelloy Alloy X to Inconel and to Mild Steel. Careful joint preparation, correct welding techniques and a special electrode are used. ***Carl Johnson.*** *Industry & Welding*, v. 32, Feb. 1959, p. 40-42.

4833* Thermit Welding Salvages 25-Ton Mill Parts With 3,200 Lb. Weld. Claims the quickest and cheapest way to repair very thick parts is to thermit weld them. *Industry & Welding*, v. 32, Feb. 1959, p. 46 + 1 page.

4834* Tungsten Inert Arc Welding. Current selection guide tells whether to use a.c. or d.c. power. ***Frank Kuncz.*** *Industry & Welding*, v. 32, Feb. 1959, p. 55-56.

4835 Electric Process Welds Rail Into Continuous Ribbons. *Iron Age*, v. 183, no. 3, Jan. 15, 1959, p. 92-93.

4836 Simple Spray-Brazing Process Makes Tough Jobs Easy. If welding thin steel sections in hard-to-reach places is exasperating or impossible, this spray-brazing technique should be tried. ***Harry E. Miller.*** *Iron Age*, v. 183, no. 5, Jan. 29, 1959, p. 85-87.

4837* Prevention of Brittle Fracture in Welded Structure. Stress relieving heat treatment is adopted preventing brittle fracture and for softening of heat affected zone, prevention of stress corrosion, improvement of fatigue strength, and prevention of deformation which might occur during service. ***Hiroshi Kihara and Kōichi Masubuchi.*** *Japan Welding Engineering Society, Reprints*, 1958, Apr., 5 pp.

4838* Metallurgical Function Stability of Arc Welded Joints in Unalloyed and Low Alloy Structural Steels. Durability and performance of welded joints and welded construction as a whole with regard to application and calculated lifetime. (*In Swedish.*) Metallurgisk funktionsstabilitet hos bågsvetsförband i olegerade och låglegerade konstruktionsstål. ***T. M. Norén.*** *Jernkontorets Annaler*, v. 142, no. 11, 1958, p. 661-719.

4839* Diminishing the Strength of Plate Welding Under the Influence of Low Temperatures. In the refrigerating treatment, low carbon steel loses in ductility, turning fragile, only temporarily. After heating to the ambient temperature, the ductility is recovered and the steel becomes suitable for pressing. ***P. Zasukha.*** *Kholodil'naia Tekhnika*, v. 35, no. 6, Nov.-Dec. 1958, p. 27-29.

4840 Adhesive Bonding of Titanium. Two problems have tended to retard the development of adhesive-bonded titanium structures: adhesives that can be used at elevated temperatures for long periods of time and suitable surface treatments to prepare titanium for bonding. The most promising adhesives are modified phenolic-epoxy resins; however, considerable effort is being exerted to develop ceramic adhesives, organic adhesives, and semiorganic adhesives for high temperature applications. Several surface treatments, such as anodized coatings, vapor plating of aluminum and gold, and acid etching, have been developed to the extent that bond strengths obtained with titanium compare favorably with those obtained with aluminum. ***H. E. Pattee, C. F. Faulkner, and P. J. Rieppel.*** *Light Metal Age*, v. 16, Dec. 1958, p. 22 + 4 pages.

4841 Choosing and Using Rubber-Base Adhesives. A primer on adhesive selection: thermoplastic and thermosetting compositions, effects of additives on bond properties, industrial applications. ***R. K. Humke.*** *Machine Design*, v. 31, Jan. 8, 1959, p. 128-132.

4842 Dip Brazing Magnesium. Technique used in waveguide manufacture. *Metal Industry*, v. 93, Dec. 19, 1958, p. 513-514.

4843 Welding Heat Exchangers for Nuclear Power Plant. *Metallurgia*, v. 58, Dec. 1958, p. 297-298.

4844 Metals and How to Weld Them. Metallurgical fundamentals; properties of cast irons, steels, and other metals; methods and applications of various welding techniques; hard surfacing. ***T. B. Jefferson and Gorham Woods.*** 322 pp. 1954. The James F. Lincoln Arc Welding Foundation, Cleveland. (TK4660 J35m)

4845* Multiple Arc Trebles Welding Speed. An automatic, multiple-arc welding set-up travels three times as fast to produce better parts with less handling. *Metalworking Production*, v. 102, no. 51, Dec. 19, 1958, p. 2224-2225.

4846* Induction Brazing Overcomes Distortion of Fabricated Carbine Barrel Casings. Problems of distortion were eliminated by special high frequency induction brazing methods. ***Peter Trippe.*** *Metalworking Production*, v. 102, no. 52, Dec. 26, 1958, p. 2255-2257.

4847* Wide-Gap Brazing Alloy Joins Engine Rings. New brazing alloys join such difficult materials as high-temperature Ni-base alloys with high Ti and Al content. They are used to join blades to rings in nozzle diaphragms for gas turbine engines. ***R. C. Kellner.*** *Metalworking Production*, v. 103, no. 1, Jan. 2, 1959, p. 16-17.

4848 Non-Manual Pipeline Welding. Possible methods are submerged arc, flash, induction pressure, or consumable electrode welding. ***William B. Handwerk.*** *Petroleum Engineer*, v. 31, Jan. 1959, p. D40-D41.

4849 Resistance Welding of Pipelines. Surveys developments in the USSR. ***B. E. Paton, et al.*** *Petroleum Engineer*, v. 31, Jan. 1959, p. D-47 + 3 pages.

4850 An Apparatus for Testing the Solderability of Wire. Describes a test carried out under standardized conditions that closely approach practical conditions. ***J. A. ten Duis.*** *Philips Technical Review*, v. 20, no. 6, Dec. 1958, p. 158-161.

4851* Develop Ultrasonic Welder for Joining Dissimilar Metals. *Plant*, v. 19, Jan. 1959, p. 46.

4852 Joining Aluminum. Some notes on how to solder, braze, and weld extrusions and castings. *Precision Metal Molding*, v. 17, Jan. 1959, p. 52-53.

4853 What Do the Russians Weld With? Reports on design and performance of the latest Soviet production welding machines. Includes electro-slag welders for ultrathick sections, portable submerged-arc welders, and stored-energy spot welders for delicate assemblies. ***Peter Trippe.*** *Product Engineering*, v. 30, no. 3, Jan. 19, 1959, p. 64-67.

4854* Tests on Welded Titanium. Tests on titanium and TA5E alloy concerned with: (a) the process of argon welding (in enclosed box or with carriage); (b) the static and dynamic properties of the joints obtained; (c) metallographic examination. A comparison is made with results obtained on welded steels. (*In French.*) Essais sur titane soudé. ***R. Lachenaud.*** *Revue de Métallurgie*, v. 55, Nov. 1958, p. 1065-1072.

4855* Present State of the Brittle Fracture Problem. Study of one of the causes of the ruptures of mild steel structures, due to fatigue, or fatigue and corrosion. Characteristics of brittle fractures, inception, effects of temperature, relationship between strength and resistance, welding and protection. (*In French.*) Etat actuel du problème de la rupture fragile. ***G. M. Boyd.*** *Revue de la Soudure*, v. 14, no. 4, 1958, p. 175-187.

4856* Evolution of the Hydrogen Content and of the Mechanical Properties of Coated Electrode Arc Welding as a Function of Time. Tests to determine the rate of decrease as a function of time, of the H content of the metal deposited with different types of electrodes. The measurements were completed by simple tensile tests. (*In French.*) Evolution de la teneur en hydrogène et des propriétés méchaniques des soudures à l'arc avec électrodes enrobées en fonction du temps. ***W. Hummitzsch.*** *Revue de la Soudure*, v. 14, no. 4, 1958, p. 213-221.

4857* The Use of Protective Gas as Protection Against Oxidation During the Welding of Alloy Steels. Causes and effects of oxidized roots in welded seams. Prevention of oxidation at the root of a welded seam. Economic use of a protective gas. Protection against accidents. (*In German.*) **J. Wingerath and K. Boeckhaus.** Die Verwendung von Formiergas als Oxydationsschutz beim Schweissen legierter Stähle. *Schweissen und Schneiden*, v. 10, Dec. 1958, p. 471-475.

4858* Contribution to Design and Calculation of Welded Hollow Bodies for High Pressures and High Temperatures.

Influence of stress conditions on the distortion of hollow bodies. Comparison between various solutions for the construction of large heavy gage vessels. Determination of stress distribution, distortion and rupture strength. (*In French.*) Contribution à la conception et au calcul de corps creux soudés pour hautes pressions de service et températures élevées. ***Albert F. Maier.*** *Soudage et Techniques Connexes*, v. 12, nos. 11/12, Nov.-Dec. 1958, p. 404-412.

4859* **The "Caravelle" and Spot Welding.** Welding methods and equipment used for the 300,000 spot welds joining aircraft stringers and light alloy Al-Cu and Al-Cu-Zn skin panels. (*In French.*) La "Caravelle" et le soudage par points. ***J. Coupain.*** *Soudage et Techniques Connexes*, v. 12, nos. 11/12, Nov.-Dec. 1958, p. 422-432.

4860* **Contribution Relative to the Joining of Clad Metals and to Cladding Techniques.** Manufacture and properties of clad steel. Fabrication, cutting, and welding methods for various materials and types of assemblies. (*In French.*) Contribution relative à l'assemblage des métaux plaqués et à l'exécution de doublages. ***H. Gerbeaux.*** *Soudage et Techniques Connexes*, v. 12, nos. 11/12, Nov.-Dec. 1958, p. 441-459.

4861* **Problems in Development of Equipment for Electric Arc Welding.** Analysis of the modern state of welding engineering. Basic development trends of welding equipment. (*In Russian.*) Voprosy razrabotki oborudovaniia dlia dugovoĭ elektricheskoĭ svarki. ***I. Ia. Rabinovich.*** *Svarochnoe Proizvodstvo*, 1958, no. 12, Dec., p. 6-9.

4862* **New Injectorless Equal Pressure Equipment for Gas Welding and Surfacing.** Russian research developments. (*In Russian.*) Novaia bezinzhektornaia apparatura ravnogo davleniia dlia gazovoĭ svarki i naplavki. ***V. D. Nechaev.*** *Svarochnoe Proizvodstvo*, 1958, no. 12, Dec., p. 17-20.

4863* **Modernization of MCM-150 Butt Welding Machine for Flash Welding of Austenite Steel Pipes.** Modernization of butt welding equipment permits flash welding of austenitic steel pipes of a section up to 650 mm². (*In Russian.*) Modernizatsiia stykovoĭ mashiny MCM-150 dlia svarki trub iz austenitnykh stalei. ***A. F. Kozhaev.*** *Svarochnoe Proizvodstvo*, 1958, no. 12, Dec., p. 27-29.

4864* **Seam Welding Machine for Stainless Steel Parts of Unequal Thickness.** (*In Russian.*) Shovnaia mashina dlia svarki detaleĭ raznoĭ tolshchiny iz nerzhaveiushcheĭ stali. ***F. A. Aksel'rod and M. P. Zaĭtser.*** *Svarochnoe Proizvodstvo*, 1958, no. 12, Dec., p. 33-35.

4865* **Operation of Tube-Welding Furnaces When Using Natural Gas.** Natural gas increases output; carburetion is unnecessary. (*In Russian.*) Rabota truboivarochnykh pechei na prirodnom gase. ***A. I. Fridland and V. M. Markevich.*** *Stal'*, v. 18, no. 12, Dec. 1958, p. 1142-1144.

4866 Joining and Assembly. Forum on technical progress in 1959. *Steel*, v. 144, Jan. 5, 1959, p. 362 + 7 pages.

4867 Weldability of Low Alloy Steel for Boiler Tubes. Typical propetries of low alloy steels used for manufacturing boiling tubes. Shows that it is practically impossible to obtain in the intermediate zone the hardness required by the standard. (*In Czech.*) Svařitelnost nizkolegovaných ocelí na kotlové trubky. ***R. Šejnoha and R. Rohan.*** *Strojírenství*, v. 8, no. 11, Nov. 1958, p. 851-857.

4868 Special Welding Techniques. Covers the selection of welding equipment, the design of tooling, and the development and comparative evaluation of joint configurations and weld schedules, usually with Inconel. ***John Mueller, William Maxwell, and James Siltanen.*** *U. S. Atomic Energy Commission, MND*-1045, Jan. 1957, 87 pp. (UF767 Un3.1mn Contin.)

4869* **Cementing of Steel With Plastics Adhesives.** Behavior and load carrying capacity of cemented steel joints involving large material thicknesses. Tests indicate that considerably higher bond-shear strengths are obtainable with cold-curing plastics bonding cements. (*In German.*) Kleben von Stahl mit Kunstharzklebern. ***Karl Möhler.*** *VDI Zeitschrift*, v. 101, no. 1, Jan. 1, 1959, p. 1-8.

4870* **Electric Resistance Welding Machines and Their Control.** Electronic control enables a procedure to be carried out to a pre-set program. (*In German.*) Elektrische Widerstandschweissmaschinen und ihre Steuerung. ***Wolfgang Graf Schack von Wittenau.*** *VDI Zeitschrift*, v. 101, no. 1, Jan. 1, 1959, p. 13-14.

4871 Aluminium Bridge Construction. Depicts role of welding in recent U. S. construction. *Welding and Metal Fabrication*, v. 27, Jan. 1959, p. 14-16.

4872 Contraction in a Welded Propeller Shaft. A theory to account for the contraction of 1.25 inches in length is advanced, together with details of its experimental verification. ***D. Birchon.*** *Welding and Metal Fabrication*, v. 27, Jan. 1959, p. 17-21.

4873 Torch Brazing and Hard Soldering Pure Titanium in Air. A patented composition of 30-35% Cu and 70-65% Ag as chloride is used. ***R. C. Shelley.*** *Welding and Metal Fabrication*, v. 27, Jan. 1959, p. 31-32.

4874 Fabrication of Aluminium Pressure Vessels. II. Covers cleaning, welding methods, preheating and stress-relieving, finishing of welds, and testing and inspection. ***J. F. Lancaster.*** *Welding and Metal Fabrication*, v. 27, Jan. 1959, p. 33-34.

4875 Thousands of Precision Welds for a Sensitive Giant. Design and assembly of the Owens Valley radio telescope. *Welding Engineer*, v. 44, Feb. 1959, p. 29-31.

4876 New Pipeline Welding Method Makes U. S. Debut. Describes as a "magnetic girdle," the device holds the electrode in position, controls the arc, and directs the flow of molten metal in the magnetic field. ***Ted Jefferson.*** *Welding Engineer*, v. 44, Feb. 1959, p. 44 + 1 page.

4877 Plasma Heat—Newest Addition to Welding's Product Lineup. Applications to welding are discussed. *Welding Engineer*, v. 44, Feb. 1959, p. 50 + 1 page.

4878 Alloy Welding Fluxes for Low-Alloy Steels, Stainless Steels and Hard Surfacing. With only four primary fluxes and one neutral flux, many alloy combinations can be compounded to meet the requirements of the particular application for which the flux is needed. ***R. A. Wilson.*** *Welding Journal*, v. 38, Jan. 1959, p. 20-27.

4879 Inert-Gas Consumable-Electrode Welding of Thin Material. Process is capable of welding the common materials in a range of thickness from 0.015 to ¼ in. at high production speeds. ***T. McElrath.*** *Welding Journal*, v. 38, Jan. 1959, p. 28-33.

4880 Joining Aluminum With High-Zinc Solders by Abrasion Soldering. At temperatures above 700 F, high-zinc solders become molten and alloy readily with aluminum when the aluminum surface is subjected to a slight abrading action under the molten solder. ***O. R. Singleton, Jr.*** *Welding Journal*, v. 38, Jan. 1959, p. 34-36.

4881 The Weld Heat-Affected Zone. Effect of weld thermal cycles on the microstructure and mechanical behavior of the base metal in the heat-affected zone is described by 1958 Adams Lecturer. ***Ernest F. Nippes.*** *Welding Journal*, v. 38, Jan. 1959, p. 1s-18s.

4882 Welding Stainless Steel to Carbon or Low-Alloy Steel. Traces the historical record of development and successful application of the practice; considers difficulties which have arisen, and proposes aids and limitations. ***John J. B. Rutherford.*** *Welding Journal*, v. 38, Jan. 1959, p. 19s-26s.

4883 Carbon-Dioxide-Shielded Metal-Arc Welding of Carbon-Steel Plate. Several types of carbon-steel plate, with carbon contents up to 30%, and in thicknesses up to 1½ in. have been successfully welded with this process. ***R. J. Keller.*** *Welding Journal*, v. 38, Jan. 1959, p. 27s-38s.

See also: **3878** (Hortonspheroid welding); **4142** (arc welding costs); **4560** (inspection of welds); **4607** (specifications for welded reactor components).